

EDWARD WINSLOW

AN
ANATOMICAL EXPOSITION
OF THE
STRUCTURE
OF THE
HUMAN BODY.

By JAMES BENIGNUS WINSLOW,
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TRANSLATED FROM THE FRENCH ORIGINAL,

By G. DOUGLAS, M.D.

ILLUSTRATED WITH COPPER-PLATES.

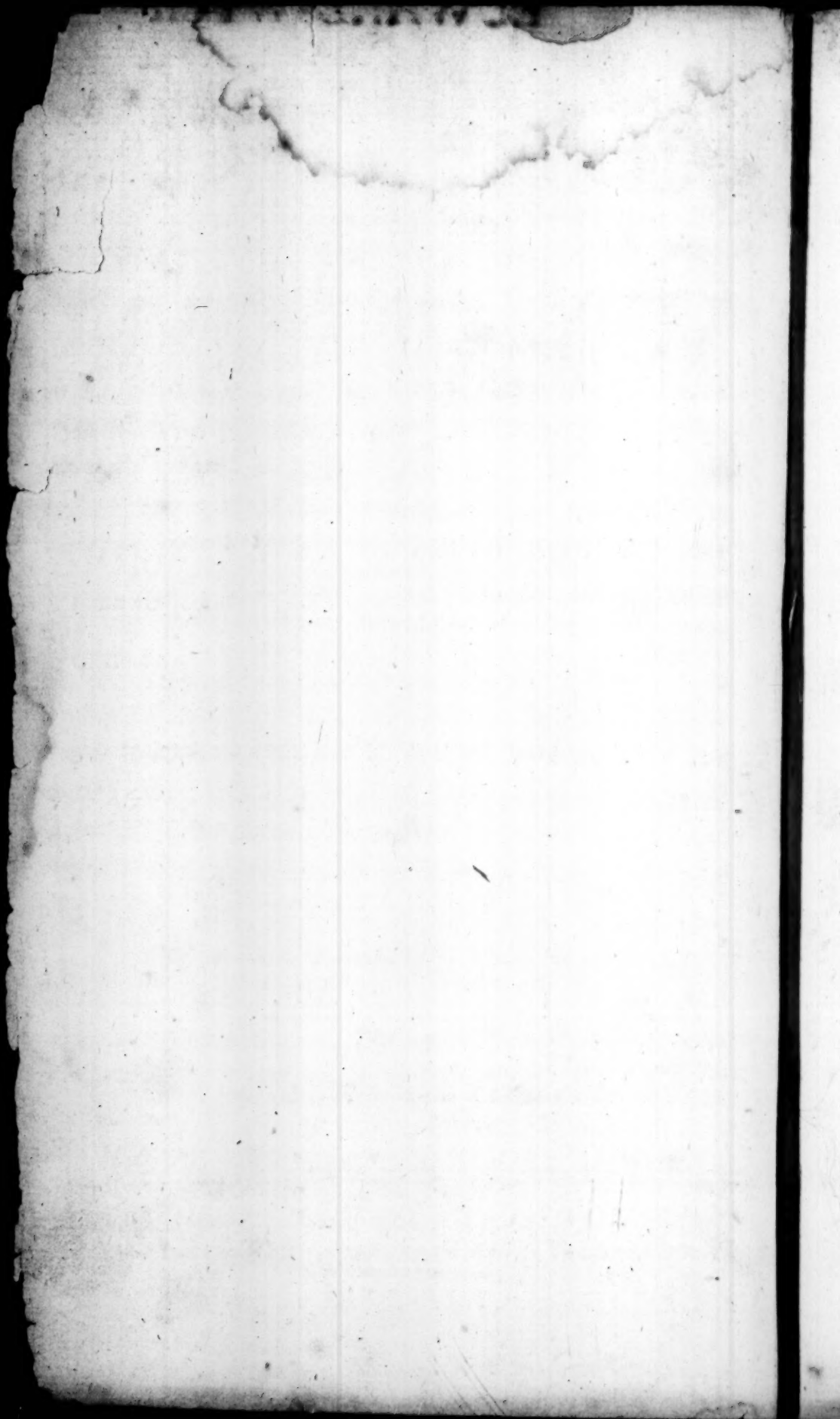
IN TWO VOLUMES.

VOLUME I.

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T O

Dr. JAMES DOUGLAS.

S I R,

WHAT I here take the liberty to offer you, is already more your own than mine. To you I owe all that I know, not only of the science, but of the style of anatomy; and there is not one good line in this translation, which is not the better for what you have taught me, or procured me opportunities of learning. These are very great obligations to a man resolved to live by the profession of physic; but they are very small, when compared with others that you have laid me under, without which I should never have been in a condition to live by any profession. Pardon this public acknowledgment of favours which you designed to have kept always secret; and continue to believe me, with the utmost sincerity, gratitude, and respect,

S I R,

Your most dutiful,

Bow-Lane,
Sept. 5. 1732.

Most obliged brother,

G. DOUGLAS.

AUTHOR'S ADVERTISEMENT.

IN room of a preface which I once intended, the following advertisement will be sufficient to inform my readers, concerning the design and disposition of this treatise, and concerning several other particular circumstances which it is proper they should be acquainted with, before they begin to peruse it.

I entitle this work, *An anatomical exposition of the structure of the human body*, because my design is simply to relate that structure, as I have found it by dissections often repeated, and in different manners; and because I confine myself entirely to the human body. I have not enlarged very much on the uses of the parts; I mention those alone, which appear to me to be well founded on the known structure of the body; and sometimes I say nothing of them at all, as knowing nothing certain about them. In that case, I frankly acknowledge my ignorance, in order to excite others who, perhaps, may be more lucky than I have been; and I design, in another work, to give a fuller account of these uses.

I have followed the same general order which is observed by Vesalius in his great work *de corporis humani fabrica*; beginning by the bones, and from thence going on to the muscles, arteries, veins, nerves, abdomen, thorax, and head, together with the organs of sensation; and I more willingly pitched upon this method, because I formerly designed to have published a *Vesalius Renovatus*.

THE AUTHOR'S ADVERTISEMENT. v

It is for this reason, that the particular treatise, which I call *A compendious view*, &c. sect. 7. is placed where, in all appearance, it ought not to be; and that I have been obliged to make this compendious view, partly a recapitulation of the sections that go before it, and partly an introduction to those that come after.

My great care has been to follow an easy, simple and instructive method, for the sake of beginners, and of those who have not made any great progress in anatomy. I never talk of parts supposed to be unknown, while I describe the rest; and I never begin the particular description of any part, without giving first of all a general idea of it.

Thus in the treatise of the muscles, I confine myself to those which are wholly inserted in bones, because, in the foregoing sections, I described the bones. I mention no muscles fixed in other organs or viscera, as for instance those of the eye, because that organ was not described before; and therefore it would be impossible for a beginner to understand my meaning; especially in naming the particular portions of the eye, in which the several muscles are fixed.

I have observed the same method through this whole work, passing always from known parts, to those that are unknown; and I have shunned, as much as was possible, entering upon particular descriptions, till I have first communicated general ideas, as may be seen by the advertisements inserted in each section, on this subject.

It was on this account, that I placed the description.

description of the fresh bones, with all that belongs to them, immediately after that of the skeleton; in doing which, I had chiefly regard to the muscles wholly fixed in bones; several of which are not inserted immediately in the bones themselves, but by the intervention of a ligament, aponeurosis, &c.

I am apt to think I have done a great service to beginners, in composing two particular tables, in order to facilitate the knowledge of the muscles; one of which shews at first sight, in how many bones each particular muscle is inserted; the other, to how many muscles each bone gives insertion. In the first table, each muscle makes a particular title, under which is a simple enumeration of all the bones in which it is fixed: in the second, each bone makes a title, under which is placed a list of all the muscles inserted in it.

These two tables seem to me to be of very great use in the practice both of physic and surgery, by teaching in a moment, those who have not been much accustomed to dissections, to how many several bones a wounded or otherwise disordered muscle is connected; and likewise with how many muscles a luxated, fractured, or otherwise disordered bone is connected, especially when, for want of time or of patience, they have not an opportunity of consulting the whole description of the bone or muscle concerned.

It is with the same design, that I have, in the compendious view, &c. given a short enumeration of all the external and internal parts of the human body; adding to each part, a list of the principal

principal ramifications of arteries, veins, and nerves, which, in their ordinary course, have any relation, connection, or communication, therewith. I design hereafter to make these lists more complete, and to dispose them in a better order.

As it was my intention, that this work should be purely dogmatical, and that the facts set down in it, should stand entirely on the credit of my own observations made on human bodies, during many years past; I resolved not to mention a great number of relations, histories, foreign circumstances, disputes, quotations, &c. which may be proper enough in treatises containing only particular inquiries, observations, criticisms, and such like.

I am however very far from derogating in the least from the merit of any of those great men and faithful observers, to whom we owe the numerous fine discoveries that have been made, and the excellent writings that have been published. On the contrary, I had resolved in a larger work in Latin, to place at the bottom of the pages, a sort of anatomical chronology, in order to do justice to the true discoverers, and to shew that we are often deceived in thinking we have found out something new.

I have not divided this work into books and chapters, but only into several treatises (or sections,) the titles of which shew what they contain; and I have expressed, by other particular titles, the several parts or articles belonging to the subject of each treatise. I have, for the ease of

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of the reader, divided the text of each section, into a great many different paragraphs, and there are likewise smaller subdivisions, to which I have prefixed a continued series of numbers, which facilitates the references, and will make the quotations from different editions, uniform.

As I was resolved to have no figures, but what were drawn from the life, under my own direction; and as the impatience of several persons, for whom I have the greatest respect, would not allow me time to finish the whole series of those which I have already caused to be done; I designed to make them the subject of another work, which will contain at least fourscore folio plates, with a short explication of each, in Latin and French. But I foresee that such a work will be beyond the power of any one private person.

In the mean time, my friends were of opinion that I should point out, in the several books of anatomy, the figures which I judged to express each part of the human body in the best manner. But I must frankly own, that I know but a very small number that are proper for a regular collection, and even these are imperfect in some parts; and though these imperfections may be of very little bad consequence to good judges; they may nevertheless make false impressions on the imaginations of beginners, as I shall shew at a proper time, in a dissertation on anatomical figures in general, and on those of Casse-rius, Eustachius, Vidus Vidius' &c. in particular; but I know nothing of the Roman edition of seven figures of the human nerves, which Ri-
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olan commends so much in his notes on Vesslingius.

Notwithstanding all these reasons, which determined me to publish no figures at present; several of my friends having insisted very much on the necessity of my having at least a few, I was obliged, at length, to consent to copy four of Eustachius's plates; and as I left them to the choice of my friends, they pitched on those which are here inserted. I caused them to be copied from the Roman originals, explained by the late M. Lancisi; and to his explications I have added some of my own.

Eustachius had directed particular methods for finding the places in these tables which wanted to be explained; but M. Manger, who has published the whole, at the end of his *Theatrum Anatomicum*, has marked the explications in the common way by letters and numbers. This alteration was approved by Lancisi, and I have here retained it; Eustachius's manner not being suited to every person's capacity.

I formerly contrived the following method for making use of those tables with more ease. I draw squares of five degrees, with black lines, as in the tables *AA*, *BB*, and afterwards complete these lines with a red transparent liquor, such as the tincture of Brazil wood, on the figures themselves. Then on each large black and red square I draw twenty little squares, with a yellow transparent liquor, such as the tincture of saffron, as I have done in the table *BB*, by pointed lines. The use of this contrivance is to find the upper

and lateral degrees to which the numbers in Lancisi's explications correspond.

I design on some other occasion to give the observations I have made on what the modern anatomy has discovered to be wanting in these tables, which must however always continue to be admired by all true and learned anatomists. The table *B B* alone was as great a masterpiece at the time when it was done, as the tables of the nerves, published by the late famous M. Vieussens, still continue to be; for no person can say that he has hitherto seen any better or any so good.

I write in a close, concise style; but I have taken all imaginable pains to render it clear and intelligible, and I have shunned all obscure and equivocal expressions. I have endeavoured after simplicity as well as brevity, and I have continually had these two things in view in composing this work. For as to brevity, I considered that the greatest number of those for whom I write, want only the essential and necessary parts of this science; the rest serving only to enhance the price of my book, and so to hinder them from buying it.

I studied the other property of style, simplicity, on account of foreigners, whom I must have obliged very much, by shunning all such Gallicisms as they must be apt to mistake, who are not perfectly acquainted with the genius of the French tongue. These reasons will, I hope, obtain my pardon from those who love a voluminous, more than a concise style, and from those
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also who do not here find all the politeness of which their own language is capable.

Several years ago I was informed, that if I did not publish myself, what I had said and demonstrated in my courses of anatomy, especially in those given at my own house, where I often talk without the least reserve, I should have the mortification to find that some other person would do it for me. But nothing of this kind was able to persuade me, either to precipitate a work, which is always much easier in the hands of compilers, than in those of the author; or not to behave, in the succeeding courses, with my usual openness of mind. And I was even so indifferent about this objection, that I have often corrected with my own hand, what my scholars had written during my lessons and demonstrations.

Among the great numbers of those who have attended my courses, I have found but very few that have published as their own, what they learned from me; and I acknowledge with the utmost gratitude, the generous behaviour of many foreigners, in relating in their dissertations, what they had heard me say, either at my own house, in the physic-schools, or at the royal garden where I was employed by the late great M Duvernay, to teach for twelve years, his bad state of health not permitting him to undergo that fatigue himself.

And upon this occasion, I cannot help commending the sincerity of that gentleman who translated Dr. James Douglas's English myography into Latin, in declaring in his notes, that I am the author of several things, which I had only

ly mentioned by word of mouth, without having then published them in print. And this leads me to take notice of another instance of sincerity, of a person, who having collected in writing all that he could, during several of my courses, put the whole into my hands before he left Paris, with this inscription: *Hæc tua sunt*: This person was M. L'Archevêque, a physician of Rouen.

In the year 1722, I composed a treatise called *Fundamental Anatomy*, and it was for some time before the examiners appointed for that purpose; but I afterwards withdrew it, and changed it into this which I now publish, which differs very much from the other, both in method and in length. There are a great number of errata, owing to the impatience of the public, which would not allow me time to revise the proofs so often as I should otherwise have done. I beg that these faults may be corrected first of all, that my expressions may not be mistaken, or errors be imputed to me, of which I am not guilty.

I conclude by acknowledging with sincere gratitude, that the late M. Steno's discourse on the anatomy of the brain, was the sole original source and general rule of my conduct in all that I have done in anatomy; and I have it inserted in the description of the head, believing that I should oblige my readers by reprinting a piece which was become very scarce, and which contains a great many excellent advices how to shun errors and discover truth, not only in relation to the structure and uses of the parts, but also in relation to the way of dissecting, and of making anatomical figures.

THE TRANSLATOR'S
P R E F A C E.

THE laborious and indefatigable M. WINSLOW, author of this system of anatomy, has, in his advertisement, given us a general view of the plan and disposition of his work. My design, in this preface, is to point out a little more particularly the excellencies of the original, and then to give some account of the rules I have observed in the translation.

This work may be considered as consisting of two parts; an enumeration of phænomena or matters of fact, and conclusions or inferences drawn from thence concerning the use or office of the several parts of the body.

The order which the author proposes to follow through the whole is, to pass from known parts to those that are unknown; never to suppose a part known, or to mention it as such, till it has been previously described; and never to proceed to the particular description of a part, till a general idea has been given of it. This order he has strictly observed through the whole first volume; but it is not so easily discoverable in all places of the second, and especially in the description of the arteries, veins, and nerves; in tracing the course of which, he is obliged to mention

tion many other parts besides the bones and muscles, the only parts described in the preceding sections. Perhaps he was of opinion that had he avoided this breach of his proposed order, he must have fallen into other greater inconveniences.

The author's simple, easy, unconstrained, and intelligible method of expression, adds a very great beauty to his work, which is not a little heightened by the continued series of distinct unconnected numbers, in which each section is disposed. I have always looked upon the description of the human body, or of any other part of natural history, as on a book of geography; the main business of which is to relate observations without ornament, and in such a simple manner, as that a person who afterwards views the countries described, may be put in the easiest and readiest way to see what the author saw. A laboured elegance of style, the beautiful turns of periods, and a studied connection of all the parts of a discourse, will undoubtedly render such descriptions most pleasing to a reader of a polite and classical taste; but if he designs to be more than a reader, and to consider his author in another light than as a writer of a romance, that is, if he designs to have recourse to the originals from which these descriptions were taken; he will soon find the difference between the native simplicity and the additional ornaments of the descriptive style. Vesalius, the most elegant writer in anatomy since Celsus's time, endeavoured to imitate Cicero in his

his diction; but were Cicero to write a system of anatomy at this time, he would imitate Celsus or M. Winslow, and not Vesalius.

In the descriptive part of this work, the author has omitted nothing that has hitherto been discovered or verified by himself, during a very long course of anatomical inquiries, to which his whole study, application, and time have been devoted; and for which his genius is admirably fitted, his encouragement has been the greatest, and his opportunities the best that Europe can afford. And indeed his main design appears every where to have been what he himself tells us, in the introduction to the history of the abdomen, to give a full and accurate description of the parts of the human body, without entering very far into the animal œconomy or uses of the parts.

The general idea, by which he begins the description of each part, serves not only for a good definition, but when joined to what commonly follows concerning the figure, substance, divisions, &c. of that part, leads us insensibly into the knowledge of it, and especially lays a foundation for understanding its true situation in the body; a thing of the greatest consequence in anatomy, and in which our author has very much surpassed all the anatomical writers that have gone before him. This important branch of what he calls the external conformation of the parts, is not only excellently described in this work, but he has likewise every where cautioned beginners against the mistakes that have been

been or may be committed in dissections, by describing or delineating the situation of the parts from the parts *extra situm*. And undoubtedly beginners would do well to render themselves masters of these more obvious branches of anatomy, and especially of the true situation of the parts, before they go on to more minute inquiries, which, in order to produce any real improvement either in philosophy or physic, must be built on the former as on their only solid foundation. This is the method followed by M. Winslow, and no better example can be proposed for our imitation. No anatomist has carried the real knowledge of the inward structure of the parts to a greater length; but he never enters upon that subject, till their external conformation has been particularly and accurately described. Any tolerable judge of these matters will hardly be able to keep from laughing, when he hears a young pretender to anatomy talk of making curious injections, of deciding, by means thereof, the disputes that have arisen concerning the glandular or vascular structure of the brain, or of unfolding the mechanism of a lymphatic gland, before he knows what muscles, large blood-vessels and nerves lie on any side of the arm or thigh, and what space they occupy there, in their natural situation. Great pains have been taken to unravel the structure of the different coats of the stomach, in order to explain the manner of digestion, by persons who did not know how the two orifices of that viscus are situated with respect to each other; and we have

have seen those who have spent much time in tracing the different directions of all the fibres which compose the heart, before they know how the heart lies in the thorax, or in what direction the great blood-vessels go out from it.

M. Winslow not only describes the outward and inward structure of the parts with the greatest exactness, but likewise points out the general ways of managing these parts in order to see what he describes. This is a duty incumbent on every candid diligent anatomist, as being the readiest way to put others in a condition to examine and confirm his observations, and to save them the time which must otherwise be unprofitably spent in finding out what they might have been easily taught by the authors of these administrations: and I think I may venture to affirm, that Ruysch has lost more reputation among the sincere lovers of the progress of natural knowledge, by concealing the methods and materials of his injections, than he has gained by the discoveries made by them. I am sorry M. Winslow has not described his anatomical encheiresis at greater length; the knowledge thereof being the best introduction to the nicer parts of anatomy, on which that of the animal œconomy mainly depends. This sort of encheiresis is what now goes by the name of experiments, in all the parts of natural philosophy; and the skill in contriving these experiments is what puts the chief difference between an experimental philosopher, who invents methods how to discover nature, and a natural historian who only collects

obvious phænomena, or those which cannot well escape the eyes, ears, fingers, &c. of all who will be at pains to examine them. Observations and collections of this kind are undoubtedly of use, but it is chiefly by the former that natural philosophy has been advanced to that pitch at which it is our glory now to find it in Great Britain. “Sir Isaac Newton” (says a very great man) “was sensible that something more than “ knowing the name, the shape, and obvious “ qualities of an insect, a pebble, a plant, or a “ shell, was requisite to form a philosopher, even of the lowest rank.—We all of us remember that saying, so frequently in his “ mouth, That natural history might indeed “ furnish materials for natural philosophy; but, “ however, natural history was not natural philosophy.—It was not that he despised so useful a branch of learning as natural history; “ he was too wise to do so; but still he judged “ that this humble handmaid to philosophy, “ though she might be well employed in amassing implements and materials for the service “ of her mistress, yet must very much forget “ herself and the meanness of her station, if ever she should presume to claim the throne, “ and arrogate to herself the title of the queen “ of sciences.”

Before I leave these reflections on the descriptive part of this anatomy, I cannot help mentioning a few small faults, into which, I think, the author has fallen, and which he might have avoided. The first consists in too frequent comparisons

parisons of the figure, situation, and structure of the parts of the human body, to what belongs to other arts, no less unknown than the science of anatomy. I can see no necessity for supposing that every person who begins this study, is acquainted with architecture, fortification, joinery, carpenter's work, chemistry, *etc.* and I believe all the readers of this book will be convinced that the illustrations of the parts of the body taken from these arts, are more obscure than they would have been by a simple description without comparisons, or by making use of such comparisons only as every one must be supposed to understand.

In the next place, the author's way of applying mathematical terms is not altogether warrantable: and as few apply themselves at this time, either to the surgical or physical parts of anatomy, without being previously acquainted with such parts of mathematics, and of the application thereof to natural philosophy, as are now universally acknowledged to be necessary for such studies: I shall not be surprised to hear that beginners are startled, when they read of an irregular circle, or square, of a fibre or line transversely oblique, of a circular oval, *etc.* I must therefore beg of them to be so indulgent as to believe, that the author, who is a much better anatomist than mathematician, designed no more by such expressions, than that the figures or courses of the parts which he describes, come nearer to the figures and directions to which he compares them, than to any other.

A third thing in which I think M. Winslow somewhat to blame, is in endeavouring to introduce a great number of new terms of art without any apparent necessity. The best excuse that can be pleaded for the numerous terms of art already used in anatomy, as well as in the other sciences, is, that, by the help of these, discourse is shortened, by expressing in one word what must otherwise have been expressed by several; and for such things as must be mentioned very often, such a liberty is not only allowable, but necessary. But then, without pretending to fix the exact bounds of this licence, I believe I may venture to affirm, that there is at least a sufficient number of terms of art to be found in the writers before M. Winslow, and that the introduction of new terms amounts now to no more than to oblige students to learn a dictionary by heart; that is, to spend that time in the study of a language, which might have been more usefully employed in acquiring the knowledge of things.

Another liberty often taken by the author, to substitute new terms in the room of those hitherto universally used and understood among anatomists, is, I think, still more unwarrantable than the former; and the pretence for it, that the common terms either convey false ideas of the thing signified by them, or do not sufficiently express the true ideas, is entirely obviated by this consideration, that all terms are, or ought to be defined, and that the signification of them in anatomy ought to be extended no further than

than these definitions allow of. The muscles, for instance, hitherto commonly known by the names of *membranofus*, *palmaris longus*, *plantaris*, &c. though better described by M. Winslow, than they had ever been before, will not in any respect be better understood by means of his new names of *musculus fasciæ latæ*, *ulnaris gracilis*, *tibialis gracilis*, &c. These technical innovations have been often complained of by the greatest writers in other branches of physic. Tournefort's strongest objection to the famous Morison is, that he changes the common names of plants without necessity; and Boerhaave, in his second catalogue of plants in the garden of Leyden, deprecates the same fault committed by himself in the first. But it is still more to our present purpose to observe, that even M. Winslow, who on all occasions shews a very great fondness for new terms, owns nevertheless, that he is sometimes obliged to retain the old ones, for the reasons already given. Thus talking of the muscles of the fingers and toes, he tells us, that though he gives up all names taken from the functions commonly attributed to muscles, yet the names taken from the uses of some muscles may still be retained, *provided they be looked upon as proper names only*; which reason may be equally applied to all the old names changed by him, which, as terms of art, ought all to be looked upon as proper names.

What I have hitherto said will be sufficient to point out, to an attentive reader, the principal beauties and slight blemishes in the descriptive, that is, in the chief part of M. Winslow's anatomy.

tomy. The inferences or conclusions drawn from the phænomena he describes, come next in order. He tells us himself, that he has not much insisted on the uses of the parts, and that he mentions those only which appear to him to be well founded on the known structure of the body: frankly owning his ignorance, as to those about which he knows nothing certain, in order to excite others, who may perhaps be more lucky in discovering them than he has been. He likewise assures us in many places of this work, that it was designed to be purely anatomical, that is, to contain an accurate description of the structure of the parts; and only to point out their uses in general; the farther prosecution of that curious subject being referred for another performance. Notwithstanding these repeated declarations of his design, I am very sensible that his not having insisted more on the uses of the parts, that is, his not having applied his excellent descriptions at greater length, to the animal œconomy, is made a heavy charge against him by two sorts of persons; by those of a philosophical genius, because they do not here meet with so much philosophy as they expected from an anatomist of so great reputation; and by those who have been his scholars at Paris, because they do not find all that they have heard him deliver on this subject in his private courses. In answer to both, we need only observe, that, according to our author, the solid parts of the body are the chief subject of a system of anatomy, the fluids being there taken notice of only occasionally, or as far as is necessary to explain the former; and in
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the next place, that the foundation of a complete physiology, is the description of the fluid as well as of the solid parts; that is, the nature, properties, motions, *etc.* of the chyle, blood, and all the liquors secreted from the blood, are to be inquired into and illustrated by hydrostatical, chymical, and mechanical experiments, before the animal œconomy can be explained. Therefore, in a work designed for the explication of the solid parts only, the doctrine of the animal œconomy is no farther to be expected, than as the uses of the solid parts can be pointed out, without taking in the consideration of the fluids. This our author has done, and it is very unreasonable to quarrel with him for not having done more than his subject led him to, or for not having enlarged his subject; in chusing which, every writer has always enjoyed, and ought always to enjoy a full and absolute liberty. Had he described the fluids particularly, and afterwards applied the description of the solids and fluids to the whole animal œconomy in a healthful state, it might with equal reason still have been objected to him, that he ought likewise to have given us the history of all the alterations that happen to these solids and fluids from various causes variously applied; that is, that, instead of a description of the solid parts of the body, he ought to have published an entire system of the theory and practice of physic.

Upon the whole, notwithstanding a few small mistakes which the author might have avoided, and notwithstanding all the other objections that have

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Upon the whole, notwithstanding a few small mistakes which the author might have avoided, and notwithstanding all the other objections that have

have been or may be made to his work, it will be found to contain the best system of the anatomy of the solid parts of the body that was ever published to the world. This was M. Winslow's sole design in composing it; and, by the help thereof, an industrious student may lay an admirable foundation for understanding the animal œconomy, and for the application of that necessary part of physic, to the knowledge and cure of diseases, which every physician ought always to have principally in view in his inquiries into the structure and uses of the parts.

I am in the next place to give some account of the translation I have made of this excellent work. Though such a degree of knowledge of the French, as to be able to read the books written in that language with ease and pleasure, has for many years past been reckoned an essential part of a polite and liberal education in Great Britain; yet there are a great many people, who, either from inclination or from the way of life which they have chosen, may be supposed to apply themselves more or less to anatomical studies, without being sufficiently skilled in this fashionable language. The number even of good French books, imported by our booksellers, seldom over-fond of foreign commodities, is generally very small; and for these two reasons, a good translation of a valuable original ought to be looked upon not only as the most proper way to make the original more generally known, but also as a new edition of a book with which we could not otherwise be easily supplied. The
same

same apology will serve for good translations of good books written in all the other living languages.

It is laid down as a general rule, that, in all translations, the author ought to be made to express himself in the same manner as if he had written originally in the language into which his work is translated. With respect to the dead languages, especially the Greek and Latin, I believe this rule will hold; and I dare say every reader would be very much pleased to find in an English version of Celsus or Aretæus, the same beauties which good judges have discovered in the originals: but with respect to the French originals this rule must admit of some limitations. Without entering into a particular detail of the different genius of the English and French languages, or of the writers in each language, it will be sufficient for my present purpose to make two observations; first, that the generality of the French writers think themselves obliged to express a great many things which the English leave to be supplied by their readers; and secondly, that the French words are, in many cases, signs of less complex ideas than the English. From these varieties, which might be very easily traced to their true sources, it follows that the French are the best writers on the elements of sciences, and that the English writings are a great deal more concise than the French. M. Winslow's book confirms what I have said; for as no complete anatomical treatise was ever so well calculated for beginners, so had he lived

as many years in London as he has lived in Paris, his book would have appeared in a much smaller volume than it does at present; and therefore when he tells us that he writes in a close, concise style, he must be supposed to have compared it only with that of the other French writers in anatomy; for when compared with that of the writers in several other languages, both dead and living, it is certainly very diffused. It would nevertheless have been an unpardonable liberty in an English translator to have reduced the original into the small form in which it might have been written by the author in that language; for in that case I should have been thought to have given rather an abridgment than a translation of the original. My chief business therefore as a translator, was to express the author's thoughts in his own way, as far as was consistent with the propriety of the English anatomical style.

I have given most of the terms of art in Latin, because they are most familiarly used by English anatomists in that language; and for that reason I judge them to be as really English words as if they had been originally derived to us from the Britons, Saxons, Danes, or Normans; for, after all the efforts made, whether by grammatical or logical pedants, use will and must remain the sole standard both for speaking and writing; and Bishop Wilkins's project for flying to the moon, was every whit as feasible as that for establishing a philosophical language.

There are some words in the original which
cannot

cannot well be rendered either by Latin or English terms without a circumlocution, or without taking some other liberties. *Le trou mentonier* in French signifies the external orifice of that canal in the lower jaw which transmits the inferior maxillary nerve, or the third branch of the fifth pair: but as there is no adjective either in Latin or English which answers to the French one *mentonier*, that expression cannot be translated without a circumlocution. The word *attache* signifies what is commonly called in English both the origin or beginning, and insertion or ending of muscles: but as I could not, consistently with my author's meaning and design, use these English words, either indifferently or as they have been commonly used hitherto; and as there is no one word in English that I know of, which expresses both significations of the original term; I have taken the liberty to affix that meaning to the word *insertion* by which I have constantly translated the French *attache* when applied to muscles.

On a cursory view of the original, when I first undertook the translation, I judged that an alphabetical index would have made a very useful supplement to this English edition; and I designed that this index should have contained short clear definitions of the principal anatomical terms; and these, together with the proper references to the particular sections and numbers, would have made up a pretty complete anatomical dictionary in a small compass. But I soon found, in the progress of the translation, that

such an index would be unnecessary ; for in the first place the author has explained the principal terms of anatomy in the beginning of section VII. and the various tables which he has given us of the muscles, arteries, veins, and nerves, together with the particular enumerations of all the parts of the body, all which will be easily found by the contents, render any other particular tables or references, in my judgment, altogether superfluous. However, as I promised an alphabetical index in my proposals, if those who have done me the honour to encourage this undertaking, are not perfectly satisfied with my reasons for omitting it ; I assure them that each subscriber shall have one delivered to him gratis, done with all the exactness that I am capable of.

The want of an alphabetical index is one reason why this edition does not swell to the number of sheets which I at first proposed ; but this is chiefly owing to another cause, which it was not in my power to prevent, I mean the smallness of the character ; and this I was obliged to consent to, that my bookseller might not be a sufferer, in case the other much cheaper translation, with which we were threatened, had been published before mine. Whether the undertakers have desisted, or not, I cannot tell ; but, that such an undertaking was actually set on foot, I am fully assured upon better grounds than from what was published in one of the English journals.

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ANATOMICAL EXPOSITION
OF THE
STRUCTURE
OF THE
HUMAN BODY.

SECT. I.

A description of the skeleton, or of the dry bones.

1. **T**HE exact knowledge of the bones is the foundation of all anatomy; because, without this, we can never have a just idea of the situation, disposition, connection, and uses of the other parts of the human body, nor consequently understand or cure the disorders to which they are subject.

2. This science is termed *Osteology*, from a Greek word which signifies a discourse or reasoning upon the bones; and it is ordinarily acquired from a skeleton, that is, a collection of bones well cleaned and dried, united together in such a manner as to represent, as justly as is possible, the natural fabric of fresh bones.

3. I say as justly as is possible, because in the fresh bones we observe not only the natural consistence and colour of
VOL. I. A their

their different portions, but likewise their cartilages, ligaments, membranes, vessels, &c. as will be shown hereafter.

4. But still, though the skeleton does not come perfectly up to the natural structure of fresh bones, it is both very necessary and very useful, because we may readily have recourse to it at all times and in all seasons, in order, first, to acquire a preliminary idea of the natural state of the bony edifice, and afterwards to refresh our memory at our leisure, especially if we desire with ease and pleasure to reap the fruit of an examination or demonstration of the bones in a fresh subject, *i. e.* of a particular osteology, as it may be termed.

5. My design is to treat of the bones in both states, beginning by the history of the bones of the skeleton, or the common osteology. I shall next describe the fresh bones taken from dead bodies newly prepared, which, according to Riolan, may be termed *Osteologia Nova*.

A R T. I.

General doctrine of the bones.

*Enumeration
of the bones.*

6. **A** Natomists commonly begin osteology by the general doctrine of the bones; but as we cannot avoid mentioning several particular portions thereof as examples of what we deliver in general, it will be more methodical to give first an idea of the skeleton, by enumerating simply all the pieces of which it is composed.

7. After this enumeration, I shall lay down what relates to the bones in general, and then go on to the description of each dry bone in particular.

8. In another place I shall give some observations on the proportions which bones bear to one another, and on the differences thereof in the two sexes: But here I shall speak only of the dry bones of an adult body, that is, which has reached the utmost pitch of growth.

9. The skeleton is a regular arrangement or disposition of all the bones, that is, of all the most hard, most solid, and most firm parts of the human body, cleared from the flesh, and dried and connected together either by artificial or natural ligaments.

10. The

10. The natural ligaments soon grow hard and inflexible; they hide the extremities of the bones, and hinder us from examining each bone in particular: therefore the most instructive skeletons are those in which the pieces are joined by art.

11. The word *skeleton*, according to its original, seems only to agree to a collection of dry bones: it is however applied likewise to those which have been but newly cleaned, and which are connected by the natural ligaments.

12. The ordinary and most proper division of the skeleton is into the head, trunk, and extremities.

13. The head is divided into two general parts. The first is a bony cavity called the *scull*; the other consists of several pieces, which form the greatest part of the face; and, for this reason probably, they have been termed the *face*, though some part of the scull contributes likewise thereto.

14. The scull consists commonly of eight bones; one anterior, called *Os Frontis*, or bone of the forehead; one posterior, called *Os Occipitis*, or the occipital bone; two superior, called *Ossa Parietalia*, or sincipital, or parietal bones; two lateral, called *Ossa Temporum*, or temporal bones; one inferior, called *Os Sphenoidale*, or the sphenoidal bone; and one interior, called *Os Ethmoides* or *Cribriform*, or the ethmoidal bone.

15. Besides these we sometimes meet with supernumerary bones, the size and number of which vary considerably.

16. All the bones which compose the face, in the sense already explained, belong to the two jaws, one upper, the other lower.

17. The upper jaw comprehends not only the two large bones named *Ossa Maxillaria*, from the word *maxilla*, by which this portion of the face is expressed, but likewise the two *Ossa Malæ*, the two *Ossa Unguis* or *Lachrymalia*, the two *Ossa Nasæ*, the two *Ossa Palati*, the two *Ossa Convoluta* or lower shells of the nose, and one single bone termed *Vomer*. All these amount to thirteen in number, without reckoning the teeth, which are commonly sixteen.

18. The lower jaw is but one bone, with as many teeth as in the upper.

19. The trunk is divided in three parts; one common, called the *Spine*; and two proper, namely, the *Thorax* or breast, and the *Pelvis*.

20. The spine is composed first of twenty-four pieces called

vertebræ, seven of which belong to the neck, twelve to the back, and five to the loins; and secondly, of the bone called *Os Sacrum*, with its appendix called *Os Coccygis*, or *Coccyx*.

21. The thorax is made up chiefly of the ribs and sternum. There are twelve ribs on each side fixed by the posterior ends to the *vertebræ* of the back, the remaining parts of the thorax. The seven uppermost are called *true ribs*, and the five lowest *false ribs*.

22. The sternum consists of two or three pieces lying between the anterior ends of the *true ribs*.

23. The pelvis is principally formed by two great bones called *Ossa Innominata*, joined anteriorly to each other, and behind to the *Os Sacrum*, which completes the pelvis.

24. The extremities of the skeleton are four in number, two upper, one on each side of the thorax, and two lower joined to the two sides of the pelvis.

25. The upper extremity is divided into the shoulder, arm, fore-arm and hand.

26. The shoulder is made up of two pieces, one anterior, called *Clavicula*, and one posterior, called *Scapula*. The arm is only one bone termed *Os Humeri*. The fore-arm contains two, the *Ulna* and *Radius*. The hand is divided in three parts; the carpus or wrist, consisting of eight bones; the metacarpus, which is made up of four; and the five fingers, each of which contains three bones, called *Phalanges*.

27. Each lower extremity is divided into the thigh, the leg, and the foot.

28. The thigh is but one bone, termed *Femur*, or *Os Femoris*.

29. The leg is made up of two large bones, named *Tibia*, and *Fibula*, and of one small bone called *Patella*.

30. The foot is divided in three parts; the tarsus, which is made up of the seven following bones, the *Os Calcis*, *Astragalus*, *Os Naviculare*, *Os Cuboides* or *Quadratum*, and three *Ossa Cuneiformia*; the metatarsus made up of five bones, and the toes, which are five in number, the greatest consisting of two bones, and the other four of three bones each, called *Phalanges*, as those of the fingers.

31. There are, besides these, some small bones which are seldom met with in a skeleton, *viz.* the *Os Hyoides* or bone of the tongue, the eight *Officula Auditus* or bones of the ear, four lying in each temporal bone, the little bone sometimes found

found at the extremities of the apophyses petrosæ, towards the Sella Turcica, and the sesamoidal bones of the fingers and toes, of which two belonging to the great toe are considerable enough to be commonly preserved in skeletons.

32. I say nothing of a kind of sesamoidal bones found sometimes on the condyles of the femur, at the lower end of the Fibula, at the Os Calcis, and at the Os Cuboides.

33. After this enumeration of the bones of the skeleton, it is an easy matter to determine their number: to the head belong fifty-four, without reckoning the Os Hyoides, and bones of the ear; to the trunk fifty-four, taking the Coccyx for one bone, and the Sternum for two; and to the extremities an hundred twenty-four, leaving out all the sesamoidal bones; so that the whole number is two hundred thirty-two: to which if we add the eight bones of the ear, and the five principal pieces of the Os Hyoides, we shall have in all two hundred forty-five, the sesamoidal bones being still left out.

34. Before I go on to the particular examination of each of these bones, it will be proper to consider them in general, with respect, (1.) To their external conformation; (2.) Their inward structure; (3.) Their connection; and, (4.) Their uses.

35. By the external conformation of the bones, I mean all that may be learned about them while they remain entire; such as their size, figure, external parts and colour.

External conformation.

- 36. Some bones are large, as the Os Humeri, bones of the fore-arm; Os Femoris, bones of the leg; Offa Innominata: some middle-sized, as many bones of the head, the vertebræ, ribs, and bones of the metacarpus and metatarsus: others, in fine, are small; as those of the carpus, of the fingers and toes, the teeth, &c.
- 37. Some bones are long, as the Os Humeri, bones of the fore-arm, the ribs, &c. Some are broad, as the parietal bones, the Scapula and Offa Innominata; and there are others in which the three dimensions of length, breadth, and thickness, do not differ much from each other, as the vertebræ, bones of the carpus, patella, &c.
- 38. Some bones are symmetrical, a certain reciprocal regularity being observed between their different sides; as the Os Frontis, Os Occipitis Os Sphenoidale, Os Cribrosum, Vomer, the lower jaw, the Os Hyoides, Vertebræ, Sternum, Os Sacrum,

Figure of bones.

crum, and Coccyx. These bones are single, being placed in that space which distinguishes the right side of the body from the left.

39. The rest of the bones are double or in pairs, whereof one is situated on each side of the body. These taken singly, have not that symmetry already mentioned; but when joined to the corresponding bones on the other side, they form a regular figure, as we see in the parietal bones, *Offa Humeri*, *Offa Femoris*, &c. The other varieties remarkable in the figures of bones will be explained hereafter.

40. The external parts of a bone may be divided into one principal, which is as it were the body of the bone; and into four subordinate classes, termed *regions, eminences or risings, cavities, and inequalities.*

41. The principal part of a bone is commonly termed its *body*, which has been defined to be the middle hardest portion, at which the ossification of that bone begins.

42. But this definition will not hold universally; the bodies of the vertebræ, for instance, are neither the middle nor hardest parts of them, and the ossification of the *Offa Innominata* does not begin at that portion which is the principal part of them in an adult body.

43. By the *eminences of a bone* I understand all sorts of risings, prolongations, or productions observable on its surface.

44. These are of two kinds; in the first, the risings are continuous with the rest of the bone, and make one piece with it; in the other, they are as it were contiguous only, appearing to be parts added to, or united with the body of the bone.

45. The risings of the first kind are termed *apophyses*, from a Greek word signifying *an excrescence*, because they grow or shoot out immediately from the bone itself; such are the sharp eminences of the lower jaw, &c.

46. The others are named *epiphyses* or *appendices*, because they appear to be parts added to the rest of the bone, and still distinguished from it by the intervention of another softer substance called a *cartilage*, the thickness of which diminishing with age, it becomes at last almost insensible; and is oftentimes quite lost; so that what was an *epiphysis* in a child,

child, has the true appearance of an apophysis in a person full grown; as we see in the extremities of the Os Humeri, bones of the leg, &c.

47. We must here observe by the by, that some epiphyses have apophyses belonging to them, as in the lower extremity of the Tibia; and on the contrary, there are apophyses which have epiphyses joined to them, as in the great Trochanter; and the head of the Os Femoris is really an epiphyses of that part of the bone which is termed its neck.

48. Different names have been assigned to these two kinds of eminences, taken from their figure, situation, and uses.

49. From their figure they are termed *heads*, when they are convex, roundish, and smooth in their surface; *necks*, when they are smallest at the middle, and grow gradually bigger towards both ends; *condyles*, when two opposite sides of them are flat; *tubercles* or *tuberosities*, when they are uneven, rough, and irregular; *spines* or *spinal processes*, when they are sharp or pointed.

50. The name of *spine* is sometimes given to small tubercles, and also to long risings with sharp edges, which are likewise called *cristæ*. There are still other names taken from the figure of these eminences, which will be met with hereafter.

51. From their situation they are called *transverse*, *oblique*, *upper*, *lower*, &c.

52. Some are denominated from their uses: thus two tubercles in the Os Femoris are termed *trochanters*, because they serve to turn that bone.

53. A more particular account of the eminences of both kinds will be found in the description of each bone.

54. By cavities I mean all the depressions perceivable in the outside of bones. These are in great numbers; very different from one another, and they are called by many different names.

External cavities of a bone.

55. They may however be distinguished into two general kinds; those which receive soft parts, as the cavities which contain the brain, the eyes, the marrow, &c. and those which receive hard parts, that is, where the cavity of one bone contains the eminence of another. These last are either deep or superficial.

56. Of the deep cavities, some are termed *cotyle*, or *cotylouide*,

tyloide,) from the resemblance they bear to a vessel of that name with which the ancients measured liquors; such as the great cavity in the *Ossa Innominata*, which receives the head of the *Os Femoris*. (Others are named *alveoli* or sockets, as those in which the teeth are lodged.)

57. The more shallow cavities are termed *glenæ*, or *glenoides*, from an ancient Greek word; such as that of the *Scapula*, which receives the head of the *Os Humeri*, in the skeleton. I say, in the skeleton, because in fresh subjects, this cavity is deeper, as shall be said hereafter. These superficial cavities have scarce any sensible depth, as those in most of the *vertebræ*, in some bones of the *carpus*, *tarsus*, &c. Some of them are double, as in the upper extremity of the *Tibia*.

58. The cavities which receive soft parts differ from one another, in size, figure, &c. The names given to them are these:

59. *Fossa*, when the opening of the cavity is large or evasated, as the orbits in which the eyes are lodged. When such cavities are small, they are named *fossula*.

60. *Sinus*, when the opening of the cavity is the narrowest part of it, as in those at the lower part of the *Os Frontis*.

61. *Labyrinth*, when a cavity has several hidden turnings which communicate with one another.

62. *Hole*, when a cavity penetrates from one side of the bone to the other.

63. *Canal*, or *duct*, when a cavity runs for some considerable space in form of a tube. The orifices of such cavities are sometimes called *holes*.

64. When the cavities are very small and almost imperceptible, both they and their orifices are termed *pores*.

65. *Slit* or *fissure*, where the cavity is long, deep, and narrow.

66. *Notch*, a cavity in the edge of a bone from which a piece appears to have been cut out: *groove*, a kind of half-canal, open, and of a considerable length.

67. And when these half-canals are shallow, narrow, and many of them together, they are termed *fulci*, or *furrows*.

68. The cavities in which tendons lie, such as that at the upper part of the *Os Humeri*, are commonly called *sinuosities*; and those in which only blood-vessels and nerves are lodged, as we see in the ribs, are termed *scissures*.

69. These

• 69. These two terms are very improper, and the cavities expressed by them would be much better named *notches*, or *grooves*. Those through which the tendons pass, and which are lined with a particular kind of cartilage, might be called *channels*.

• 70. It is proper to remark here, that when a cavity is called *fossa*, or *groove*, we have no regard to the situation, but only to the figure of the things from which these terms are borrowed.

71. Besides these cavities which appear on the outward surface of bones, there are others internal, which cannot be discovered till the bones have been broken. These we must refer to the description of the internal structure.

• 72. Among the external parts of bones (No. 40.) I reckoned the superficial inequalities which are to be observed in them. Of these some serve for the insertion of tendons, others for receiving and fixing muscles: both kinds were formerly termed *impressions*, *seats*, &c. I have likewise chosen to call them *marks*, *sides*, *traces*, &c. adding the epithets of *ligamentary*, *tendinous*, *muscular*, or *aponeurotic*, to express their uses at the same time.

*Superficial
inequalities of
bones.*

• 73. These inequalities augment the surface of some bones; and render it proportionable to the extent of a membrane which covers them, called *periosteum*; of which hereafter.

• 74. Though these inequalities are partly raised and partly depressed, yet they are too superficial to be ranked among those to which we have given the names of *eminences* and *cavities*.

75. By the word *region*, I understand certain portions of the surface of a bone, determined in respect of extent, figure, situation, or other circumstances.

*Regions of a
bone.*

76. Thus with regard to extent and figure, the long bones are divided into a middle part and extremities; the broad bones into sides, angles, bases, and edges. These edges are sometimes termed *costae*, sometimes *cristae*, and they are sometimes subdivided in two lateral parts called *labia*.

77. With regard to situation, bones are divided into the upper, middle, lower, anterior, posterior, and lateral parts, and these again into external and internal, as occasion requires.

78. But in order to determine these several parts exactly, the natural situation thereof ought to be well observed, in doing which I shall always consider the subject in an erect posture. And indeed it would be proper that this rule should be extended to all the other parts of the body, that the language of anatomy might be perfectly uniform, and that one person, for instance, might no longer call that the superior part, which another calls the anterior. Such confusion may be of very bad consequence in reports delivered to judges.

79. We must likewise observe, that the words *internal* and *external*, besides their ordinary and natural signification, are taken in several other senses by anatomists.

80. In such cases I shall call that part *internal* that lies nearest a plane, which being supposed to pass from the crown of the head down between the two heels, divides the body into the right and left sides; and the part that is farthest from such a plane, I shall name *external*. Thus the edge of the orbit, near the nose, is *internal*; that near the temples, *external*.

81. I shall observe this rule likewise in the parts which compose the extremities; thus I shall call that side of the tibia *external* which is next the fibula of the same leg, and that *internal* which is next the other leg.

82. The last things to be taken notice of concerning the external conformation of bones is their colour, *Colour of a bone.* which is not only different in different bones, but in the different parts of the same bone; but this observation relates properly to fresh bones, and not to the skeleton.

Internal structure of bones. 83. All that relates to the internal structure of bones may be reduced to two heads, their substance and inward cavities.

84. The substance of bones is found on examination to be a texture of solid fibres differently disposed, according to the particular conformation of each bone. *Substance of bones.* These bony fibres are easily distinguished on the surface of the ribs, where they may be separated much after the same manner as we do those of whalebone or horn. We may likewise discover them by the fissures in bones which have been long exposed to the sun or air, or any otherwise dried.

85. In general, these fibres are so disposed, as to form in some

some bones laminæ of a considerable extent; in some, little plates or small portions of the forementioned laminæ; and in others, filaments of different sizes.

86. The general structure of the substance of bones consists in this disposition; and their substance is partly compact or solid, partly cellulous or spongy, and partly reticular.

87. The solid part lies chiefly towards the outside of bones, the cellulous part towards the inside. The first is most considerable in the large hollow bones, the other in those which have no remarkable cavities.

88. The solid part is formed by laminæ disposed in different strata. The spongy part consists chiefly of the plates and filaments variously interwoven: the filaments alone form the reticular texture principally observable in the long hollow bones.

89. We may be convinced, that the solid part of bones is made up of different strata of laminæ, closely joined together, by examining broken bones, those that have been long exposed to the air, rain, or sun, those that have been calcined by fire to a certain degree, or those that have been softened by long and violent boiling, as in Papin's digester.

90. And even without the help of such preparations, the laminæ in some bones may be seen through a good microscope; and still plainer in exfoliations, the coming away of the splinters of bones after wounds, &c. The number of these laminæ answers to the thickness of the bone.

91. Gagliardi, professor of anatomy at Rome, pretends to have observed that these laminæ are connected by means of certain small long bones, which running through them in different places, some directly, others obliquely, nail them together like so many pins.

92. These little bones, he says, seem to be transverse epiphyses of the bony fibres, of which the laminæ are composed: and that they are of various kinds and figures, straight, crooked, branched, long, and short, and that some of them have small heads belonging to them.

93. They appear, according to him, to arise from within outward in each lamina, except a few near the outer surface of the bones, the points of which are turned inwards in a contrary direction to the rest: in such a manner as that the nails or pins arising from the internal laminæ pierce several

of those that lie upon them, and each of these again send out others which pierce those that surround them.

• 94. Lastly, he says, that these little bones are not only of different kinds and figures, but of different orders likewise, and that they are found in great numbers, even in the cellular substance of bones. I cannot here take upon me to form any judgment of this doctrine, having been hitherto unable to satisfy myself so much as about the existence of these little bones, from all the experiments I have made.

• 95. To return to the laminæ, the external may be observed to lie in pretty regular strata; but in the more internal, this disposition is gradually altered, these appearing in some measure to lie in gathers or unequal folds. The innermost of all are perforated by many holes of different size and figure.

• 96. In this manner do the laminæ, which compose the solid parts of bones, change their regular disposition, to form what I call the cellulous or spongy part, which makes up almost the whole interior texture of the bones which have not large cavities, and of all the epiphyses without exception; but in the hollow bones this part is found only near the extremities.

• 97. The cells or void spaces in this spongy part are more considerable in some bones than in others; and the plates which compose them differ in form as well as in extent; being more or less flat, crooked, twisted, angular, irregular, thick, thin, broad, narrow, &c.

• 98. In many bones these plates appear to degenerate into small filaments, so that the cellulous part of such bones is, as it were, a mixture of plates and filaments, representing a kind of fine sponge. In some bones, a certain regularity may be observed in the disposition of them.

• 99. Besides the small filaments found in the cellulous part of bones, there is a reticular texture of them in the cavities of several long bones; the bony threads of which net-work are long, fine, branched, and pliable, and curiously interwoven at different distances.

• 100. This reticular texture may be said to arise partly from the sides of the innermost laminæ of these bones, partly from their extremities, and partly from the cellulous portion. Several ramifications are produced from it, which appear, as it were, suspended in the air, through the whole length of the cavity

cavity of the bone, meeting and uniting together from all quarters, in many places, which, however, are always at a considerable distance from each other. This texture is very often destroyed in taking out the marrow, when bones are designed for a skeleton.

101. Besides the cavities which appear in examining the external conformation of bones, there are others *Internal cavities of bones.* observable in examining their internal structure; which may all be reduced to three kinds, very different from one another.

102. The first kind comprehends the large internal cavities found chiefly in the middle of the long bones, which are nearly of a cylindrical figure; such as the Os Humeri, Ulna Radius, Os Femoris, Tibia, Fibula, the bones of the metacarpus, metatarsus, fingers, and toes. In these the cavities are proportionable to the length and thickness of the bones.

103. The surface of these cavities is more smooth and even in the middle than near the extremities, where they become more rough, unequal, and furrowed, according as the disposition of the laminae happens to be changed; and bony productions or cross pieces may sometimes be observed in them, which are either single or combined together in different manners. The reticular texture, already described, is chiefly found in these large cavities.

104. The second kind of internal cavities consists of the cells and intervals in the cellulous portion of bones.

105. Of these some are large, small, single, double, or more compounded, and of these last some contain several small ones within them. Others are round, flat, oblong, tubular, oval, angular, square, irregular, *etc.* And of these the oblong and tubular lie in directions nearly parallel to the length of the bone. Almost all these cells communicate with one another in different manners.

106. The third sort of internal cavities comprehends the ducts and pores found in the substance of bones.

107. Of these ducts some are very small, and lose themselves in the inner substance of the bone; the rest are larger, which having penetrated the substance of the bone for some space in an oblique direction, do afterwards pass quite through it. These latter are but in small number, and are more seldom

dom met with in the middle of bones than about their extremities and edges. The former are very numerous, and lie commonly in a direction parallel to the length or breadth of the bone.

• 108. The internal pores, though imperceptible to the eye, are plainly discovered by the yellowish matter which transudes through bones long kept without being prepared. Havers pretends to have observed the particular disposition of them, but I have never hitherto been so lucky.

109. All that has been said about the inward structure of bones may be exemplified in the Os Femoris, by sawing it through the middle lengthwise.

110. For thus we discover the three different substances very plainly; the middle part consisting of a tube, with thick sides formed by the compact or solid substance alone; the extremities made up chiefly of the cellulous substance, and the reticular substance observable in the cavity of the middle part.

• 111. The laminæ of the solid part are gradually separated from one another towards the extremities, being connected by small lateral plates differently disposed in form of cells. From this disposition the laminæ come to be of different lengths, those near the surface of the bone reaching to the very end thereof; the rest, which lie more inwardly, decreasing gradually in length: Thus the innermost lamina is the shortest; the outermost, the longest; and the intermediate ones of different lengths between these two extremes.

• 112. For this reason the solid substance of the Os Femoris is very thick in the middle, but grows gradually thinner towards each end, appearing there only as a bony crust laid over the cellulous substance. It may likewise be observed, that the most interior laminæ are less smooth and even than the other, lying, as has been said, in gathers or folds with some opening between them, and, in a word, every way irregular.

• 113. The spongy substance appears clearly enough to be made up of irregular portions or fragments of both the internal laminæ, and of the extremities of all that lie between these and the outermost.

• 114. These portions of laminæ, which I call plates, appear in some places to have something of a regular disposition:

on : for, from the middle of the bone to its upper extremity, the fragments from the outer laminæ follow nearly the same direction with the laminæ themselves ; but in those that lie more inward, and are consequently shorter, these plates gradually leave the circumference of the bone, and turn towards its axis, or that line which may be imagined to run in the middle of the bone through its whole length. From this disposition, they seem to form several vaults or hives placed one upon another, the small distances left between them being filled by another numerous order of little plates, situated some more, some less transversely. *See Plate 1820*

• 115. Below the middle of the Os Femoris, and towards the inferior extremity, the fragments are more disposed according to the length of the bone, and the little plates which fill up the spaces between them are more transverse. It may be remarked likewise, that these plates in many places, and principally towards the ends of the bone, seem to degenerate into small filaments of different sizes, which, together with the plates from which they arise, represent a kind of sponge.

• 116. In the cellular substance of both ends of the bone, some marks of the original union of its epiphyses are often to be seen. In children each of these marks has a thick stratum of cartilaginous matter, which as they grow up becomes gradually thinner and harder, and at length ossifies. In many subjects these marks are totally effaced, the epiphyses then becoming true apophyses, or at least as difficultly separable from the body of the bone as apophyses are. In other subjects this ossification remains long without being completed, and thus the epiphyses may, either by art or accidentally, be loosened and parted from the bone.

• 117. The Os Femoris furnishes us with an example, not only of the three different substances in bones, but also of the three different kinds of internal cavities. We see one large cylindrical cavity, through the whole length of its middle part ; also numerous lesser cells of various figures and dimensions formed in the interstices of the cellulous substance in both extremities ; and lastly, little eyes or holes in the interstices of the reticular substance, and where the filaments are mingled with the plates in the spongy part. We may likewise discover the small ducts, which are either distributed through the substance of the bone, or penetrate it all the way to the marrow.

marrow. The existence of the invisible pores is likewise demonstrated, through which the marrow transfuses, being first conveyed through the whole thickness of the bone.

• 118. The connection of bones is a subject which in all ages has occasioned disputes, and we find even the best authors divided in their sentiments about it. I *Connection of bones in general.* shall not here give any history of these controversies, but content myself with conveying a simple and exact idea of the thing itself, by which the reader may be in a condition to clear up and remove misunderstandings, doubts, and prejudices, and distinguish what is true and certain from what is false and doubtful.

• 119. In order to this, we need only consider well the resemblance between the structure of the bones, and that of a building; or to make the comparison more adequate, that of a moving fabric, as a ship, coach, clock, or any such other machine.

• 120. Every one will agree that two things are absolutely necessary to put together all the pieces of which it consists: First, they must be set in their proper places; and, secondly, they must be kept there. To set them in their proper places, they must be exactly proportioned to each other, whether they be designed to remain immoveable, as the beams, joists, pillars, &c. or be contrived for motion, as the doors, windows, wheels, &c. Both these kinds of pieces are formed into different shapes, that they may agree with one another, and all of them together make a commodious structure.

• 121. The several pieces being thus adjusted, are afterwards united together in different manners, by glewing, nailing, jointing, lying, hanging, chaining, &c. so that the methods, both of putting and keeping them together, must vary suitably to the form, situation, and use of each piece.

• 122. It is easy to apply what has been said to the composition of the skeleton, or rather to the natural fabric of the human bones, which cannot serve the purposes it is designed for, except the several pieces of which it consists be fitly adjusted, and then kept together by different ways. The most ancient osteologists (speaking only of the perfect bones of an adult) called the first of these *articulation*, and the other *symphyses*.

123. Ar-

• 123. Articulation thus understood is of two kinds; one moveable, by which the bones are allowed a certain degree of motion; the other immoveable, by which they are fixed together without motion. *Articulation of bones.*

The first is commonly called *diarthrosis*, that is, (according to the expression of Carolus Stephanus, an ancient physician of the faculty of Paris,) an articulation separated; the other *synarthrosis*, or an articulation conjoined.

• 124. In the *diarthrosis* or moveable articulation, the pieces are really separate; and the parts in which they touch, are each of them covered by a smooth cartilage, by means of which they easily slide upon one another. In the *synarthrosis*, or immoveable articulation, the pieces are joined in such a manner, as that the parts in which they touch have nothing particular in their surface, and cannot slide upon each other.

• 125. There is still another species of articulation, which cannot well be reduced to either of the two former, because it partakes of both; and therefore I think it necessary to establish a third kind, by the name of *amphiarthrosis*, which agrees better to this sort, than to the other articulations, to which it has sometimes been applied.

• 126. *Diarthrosis* is either manifest with large motion, or obscure with small motion. Each of these again is of two kinds; one indeterminate, or with motion many different ways, as that of the *Os Humeri* upon the *Scapula*, of the *Os Femoris* on the *Os Innominatum*; the other alternative, or with motion confined to two opposite sides, as that of the *Ulna* on the *Os Humeri*, and of the two last *Phalanges* on the first and second.

• 127. A bone is said to be moveable many different ways, when it can be turned upwards and downwards, forwards and backwards, to the right and to the left, and quite round. The motion quite round is made either on a pivot, that is, about an axis, or in the manner of a sling, where the bone describes a sort of cone or the figure of a funnel, one end of it moving in a very small space, the other in a large circle.

• 128. The first of these round motions is termed *rotation* by anatomists; the other is only a combination of several motions upwards, downwards, &c. And it must be remark-

ed, that rotation is not to be met with in all the articulations for motion many different ways; e. g. the articulation of the first phalanges with the metacarpal bones, &c. does not admit of it.

• 120. Moreover, this indeterminate diarthrosis is of two different kinds; one orbicular or globular, the other flat or planiform.

• 130. The orbicular diarthrosis is when the round end of one bone moves in the cavity of another, more or less proportionable to it, as the head of the Os Femoris in the acetabulum of the Os Innominatum; or when the cavity in one bone moves upon an eminence in another, as the bases of the first phalanges on the heads of the metacarpal bones.

• 131. The planiform diarthrosis is when the articulated bones slip upon one another, much in the same manner, as when we rub the palm of one hand against the other: this articulation is found in the bones of the carpus and tarsus, and in the oblique processes of the vertebræ.

• 132. The ancients called the first of these two kinds of articulation, *enarthrosis*; the other *arthrodia*. Some modern French writers seem to comprehend both, under the word *genou*; a term borrowed from workmen, who, probably, first ignorantly took it from the human body, to apply it to their instruments. I own that this term, as used and explained by them, agrees well enough to all the degrees of the orbicular diarthrosis; but there are undoubtedly many articulations of the other kind, so very flat, that a skilful workman would not allow them the name of *genou*.

• 133. The alternative or reciprocal diarthrosis bears some resemblance to a hinge, and for that reason the ancient Greeks termed it *ginglymus*, which signifies the same thing; and has accordingly been translated in some modern languages.

• 134. It has been divided into several kinds; but, properly speaking, I think there can be but two. The first is that which is confined to flexion and extension; and as in one of these motions the two bones always make an angle, I term it an *angular ginglymus*. This is exactly the same with the motion of a hinge. The second kind is adapted only to small turns towards each side, or to small lateral rotations, in the language of anatomists; and therefore I term it a *lateral ginglymus*.

gymus. In each kind several differences are to be taken notice of.

* 135. In the angular *ginglymus*, either each bone partly receives, and partly is received by the other, there being reciprocal eminences and cavities in each, as in the articulation of the *Os Humeri* with the *Ulna*; or there are only several eminences in one bone, received into the same number of cavities in the other, as in the articulation of the *Os Femoris* with the *Tibia*.

* 136. The lateral *ginglymus* is either single, as in the articulation of the first vertebra of the neck, with the apophysis dentiformis of the second; or double, that is, in two different parts of the bone, as in the articulation of the *Ulna* with the *Radius*.

* 137. It must in general be observed concerning these kinds of articulations, that some of them are more perfect and close than others; and that they are not all confined to flexion and extension, or to the reciprocal turns already explained, as we shall afterwards see.

* 138. The obscure *diarthrosis*, or that which admits only of small motions, is also of different kinds, as shall be shewn in the particular description of the bones. Examples thereof are found in the articulations of the bones of the carpus and metacarpus, and of the fibula with the tibia.

* 139. This articulation was formerly called *doubtful* and *neutral*, and by some *amphiarthrosis*, while others reduced it to *synarthrosis*. The first of these names might pass, the rest are improper.

* 140. *Synarthrosis*, or the articulation of bones so joined together, as to remain fixed in their situation, is of two kinds; one is made by ingrailing, and the other in the same manner as a nail or pin is fixed in wood. The first may again be subdivided into a deep and more superficial kind.

* 141. The deep kind is observable in the articulations of the broad bones. The ancients termed it *suture*, because of some resemblance it bears to a coarse seam, as is seen in the upper bones of the skull. It is made by jags, notches, and holes in each of the articulated bones, by which they are mutually indented, much after the same manner as what is called dove-

ailing by the joiners. By the ancients it was called *unguis*, probably because the indented pieces are rounded like nails. Sutures have been divided into true and false; which shall be spoke to in describing the skull.

• 142. The other kind is that which is observed in bones joined together by more extended surfaces, in which no indentation appears outwardly. This the ancients termed *harmony*, and the articulation of some of the bones of the upper jaw were given as examples of it. But though they describe it as running in a single line, they did not mean this in a strict sense, but only that the joint was like that of two rough boards without grooves. They have expressly told us, that some small inequalities might be observed in these joints; and some of them have used the terms of suture and harmony indifferently.

• 143. Suture differs very much from harmony. In the first, the jaggings and notches are very considerable, and the indentation is made likewise by small lateral eminences therein; so that the bones thus joined, cannot be separated without breaking a great many of these jags and their little eminences; whereas those that are joined by harmony, may easily be parted without breaking any thing, or at most but very little.

• 144. Harmony differs from suture, in that the inequalities therein are very small, their union is superficial, and there is no appearance of them on the surface of the bones; the joint there representing only a kind of line, more or less irregular.

• 145. The other kind of synarthrosis, an example of which we have in the articulation of the teeth, is called *gomphosis*, a Greek term still retained. I shall describe it in the history of the bones of the head, to which both these kinds of synarthrosis peculiarly belong.

• 146. The third general kind of articulation partakes of both the former two, the moveable and immoveable; *Amphiarthrosis*. and for that reason I have termed it *amphiarthrosis*, or the mixed articulation; as resembling diarthrosis in being moveable, and synarthrosis in its connection.

• 147. The pieces which compose it have not a particular cartilage belonging to each of them, as in the diarthrosis; but they are both united to a common cartilage, which, being more or less pliable, allows them certain degrees of flexibility, though they cannot slide upon each other. Such is the connection

nection of the first rib with the sternum, and of the bodies of the vertebræ with each other.

• 148. Having examined the articulation of bones, we come now to consider their union or connection, properly so called, which the ancients named *sym-* *Symphysis.*
physis; taking this term in an improper or large sense; when they applied it to the connection of bones; but in its proper meaning they used it only to signify ossification.

• 149. The authors, who say that the ancients took *sym-*
physis for a species of articulation, misunderstand them; neither are they more in the right, who advance, that the ancients looked upon articulation and *symphysis* as opposite to each other. If they speak of the most early antiquity, both these propositions are false.

• 150. In the first place, the ancients do not confound articulation with *symphysis*, but plainly distinguish them, taking articulation for the simple setting of bones together, independently of their being connected or kept together. In the second place, they do not look upon these two as opposites, that is, where they talk of articulation, they do not exclude *symphysis*; because their writings clearly shew, that in order to compose the skeleton, they thought it necessary to bring them both in together.

• 151. The words of Galen alone are sufficient to prove this. In general he tells us, "That the skeleton is a regular disposition of all the bones connected together;" and afterwards, "That their composition is by articulation and *sym-*
physis; that articulation consists in the bones being naturally ranked, *symphysis* in their being naturally connected." In fine, after having enumerated all the differences of articulation, he declares in plain terms, that by *symphysis*, or the union of bones, he understands not only that by which two or more pieces become one by age, but also that by which the bones are naturally united and connected together in different ways. Of these he reckons three (as his predecessors had done), by cartilage, ligament, and flesh. The first kind of *symphysis*, they call *synchondrosis*; the second, *synneurosis*; and the third, *syssarcosis*. He likewise takes notice, that his predecessors did not take the word *synneurosis* so far in a literal sense, as if it signified the union of bones, by means of nerves; but that they were accustomed to call both ligaments and tendons by the name of nerves, though they

they were very well apprised of the distinction of these three things.

• 152. The distinction of symphysis into that without a medium, and that with a medium, can have no place here; for the first, of which the lower jaw is cited as an example, belongs not to the connection of bones, but to their formation while imperfect; and therefore may be called *symphysis of ossification*, and the other *symphysis of articulation*.

• 153. In another sense, however, this division may still be made use of in this manner. All the pieces which compose the bony fabric are naturally connected and united together. This union or connection, which, with the ancients, I term *symphysis*, is either without or with a medium.

• 154. Symphysis without a medium, is where the articulated bones support themselves in their situation, without any other assistance than that of their conformation only: thus the parietal bones are mutually fixed by their indentations, and so give us at once an example of articulation and symphysis. In the same manner the bones in the basis of the skull are supported by those which make the convex part of it. In a natural state, however, none of these pieces touch one another immediately, but are separated by membranes which run in between them.

• 155. The connection or symphysis of bones with a medium, is of three kinds; cartilaginous, ligamentary, and fleshy or muscular; *i. e.* as the ancients termed them, by *synchondrosis*, *synneurosis*, and *syssarcosis*.

• 156. Synchondrosis, or the cartilaginous symphysis, is either moveable, as in that by which the bodies of the vertebræ are kept together, or which joins the first rib to the sternum; or immoveable, as that of the *Ossa Pubis*, in an ordinary state. The symphysis of ossification is different from this, and the union of epiphysis belongs to that, rather than to the symphysis of articulation.

• 157. Synneurosis, or the ligamentary symphysis, is found in all the joints designed for motion, in the manner that shall be shewn in treating of the ligaments.

• 158. Syssarcosis, or the muscular symphysis, is as real as the two former, and may be said to be much more general, because it accompanies and strengthens the others, and supplies what is wanting in them. The connection of the *Os*

Humeri

Humeri with the Scapula, is a sufficient proof of this: for the strength and security of that joint is owing more to the muscles, than to the ligaments.

• 159. Before we end this article, it is proper to observe, that the word *symphyfis*, taken in the sense of the most ancient Greek authors, is not more ridiculous or improper than the word *aponeurosis*, which the moderns continue to use without hesitation for any tendinous expansion, though it signifies properly a nervous expansion. Galen has even made use of this term to express all sorts of connections; and when he speaks of that of the diaphragm to the ribs, he employs the verb from whence it is derived; so that if we were at liberty to coin a new English word, we might in his manner say, that the diaphragm symphyfied to the ribs.

160. The bones are in general in respect to the body, what a wooden frame is in respect to the whole building. They give strength and posture to the body, sustain all its organs, and keep the animal in all situations proper for its functions, by means of their different conformation, structure, and connection. *Use of the bones in general.*

161. The apophyses and epiphyses dilate the ends of bones, and thereby increase the extent of the articulated parts. They make more room for the insertion of muscles and ligaments; they change the direction, and lastly facilitate the action of many muscles.

162. The external cavities receive the muscles, direct the tendons, give passage to the blood vessels, nerves, and ligaments, as we shall shew particularly in describing each bone.

163. The uses of the internal structure equally deserve our attention. The long hollow bones are very compact in the middle, and thereby secured against bending or breaking in great motions, and the strokes to which they are exposed. Their hollowness, joined to the solidity of their substance, increases these advantages; and, without augmenting their weight or quantity of matter, enables them to bear very great loads.

164. The cellulous substance in the extremities of these bones, and through the whole extent of almost all the rest which are not liable to the same dangers, gives them a large size, with a small portion of substance; and thereby procures

cures for them a sufficient extent, without any superfluous incumbrance of weight.

165. The reticular substance sustains the body of marrow with which the great cavities are filled, and the cells of the spongy substance serve to contain the separate portions of medullary juice, as shall be shewn in the history of fresh bones.

166. It is sufficient to observe about the articulations in general, that the moveable ones serve for all the motions and changes of situation of the whole body, or of its particular parts. Those that are immoveable have the same uses which carpenters or joiners find in making their works of many pieces, when they are to be much exposed to external accidents.

167. Lastly, the connection or symphysis of bones supports them in their natural state, whether they be designed for motion or not. I shall speak to all these uses at more length in the history of each bone, observing nearly the same order in which I have here mentioned them.

A R T. II.

The bones of the head.

§ 1. *The bones of the head in general.*

168. **T**HE head is composed of several bony pieces, one part of which by their connections form a kind of oval cavity properly called the *scull*. The other represents a complicated piece of sculpture, which partly supports the anterior half of the scull; and as it forms the greatest part of the face, it is called by that name.

169. Before we examine particularly each bone of the head, it is necessary, in order to prevent repetitions and obscurity, to consider the head in general, that is, as consisting of all the bones that belong to it. In this view several eminences, cavities, &c. come to be taken notice of, the formation of which is owing to more bones than one; and consequently, in examining each bone by itself, we can see but an imperfect portion of them.

170. In the language of anatomists these parts may be called common, and those that belong to some one bone only

ly may be termed proper. The common parts ought first to be distinctly known, before we go on to the proper ones; if we would shun an inconveniency otherwise inevitable, of explaining one unknown thing by another equally unknown.

171. The bony head being considered as one piece, the following particulars may be taken notice of in it: 1. Its situation in general; 2. The size; 3. The figure; 4. The external parts; 5. The internal structure; 6. The situation in particular; 7. The connection; 8. The uses. I shall follow the same order nearly, through the whole of this exposition.

172. The head is the highest or most superior part of the whole skeleton. *Situation in general.*

173. The whole head of the skeleton is spheroidal, composed, as it were, of two ovals, a little depressed on each side. One of them is superior, the extremities pointing forward and backward; the other is anterior, the extremities being turned upward and downward in such a manner, as that one extremity of each oval meets and is lost in the other, at the place particularly known by the name of the forehead. *Figure.*

174. This complex figure being viewed sideways represents a spheroidal triangle; and we ought further to observe about it, that the oval of the skull is broader behind than before, and that of the face broader above than below.

175. The upper region is termed the *crown of the head*, the lower, the *base*; the lateral regions the *temples*; the anterior, the *forehead*; the posterior, the *occiput*; the lower part of which is called the *nape of the neck*. *Regions.*

176. Some of the eminences, cavities, and inequalities are external, being visible in an entire head; others are internal, and can only be discovered by opening the skull. Both these kinds are either proper, belonging only to some one piece; or common to more pieces than one. *Eminences, cavities, inequalities.*

177. The external eminences are ten in number; two mastoide, two styloide, two condyloide, two pterygoide, and two arches, called *zygomata*. Of these five pairs, the three first are simple or proper; the other two, *viz.* the *zygomata* and *pterygoides*, are compound or common, being formed by the connection of *External eminences.*

more bones than one; the zygomata by the *Ossa Temporum*, and *Ossa Malarum*: the pterygoide eminences by the *Ossa Sphenoides* and *Ossa Palati*. To these may be added the tubercle and external spine of the occiput, and the condyloide and coronoide apophyses of the lower jaw.

178. The simple external cavities are, the parietal holes; the superciliary holes, in place of which there are sometimes only notches; the superior orbital flits; the optic holes; the external, or rather inferior orbital holes; the holes in the *Ossa Nasi*; the holes in the *Ossa Malarum*; the maxillary fossæ; the oval holes in the basis of the skull; the spinal holes; the orifices of the passages of the internal carotides; the mastoide grooves; the stylo-mastoide holes; the posterior mastoide holes; the large occipital hole; the anterior and posterior condyloide holes; the glenoide cavity and fissure for the articulation of the lower jaw; the external auditory hole; the small posterior maxillary holes; the sockets in both jaws; the internal and external orifices of the canal of the lower jaw, which last may likewise be named the *holes of the chin*.

179. The compound external cavities are the orbits, the edges of which are divided into two lateral parts, improperly called *angles*, one internal toward the nose, the other external toward the temples; the temporal fossæ: the zygomatic and nasal cavities, which last are also called *nostrils*; which have anterior and posterior openings, and are parted by a middle septum; the vault of the palate; the anterior hole of the palate, or of the incisors; the posterior holes of the palate; the pterygoide fossæ; the inferior orbital, or spheno-maxillary flits; the interior orbital holes, one anterior, and one posterior; the nasal or lachrymal duct; the duct of Eustachius, called the *aqueduct*, the small fossæ for the internal jugular veins; and the foramina spheno-palatina and lacera.

180. The internal eminences are the frontal or coronal spine; crista galli; the cella turcica, or sphenoidalis; the clinoide apophyses, apophyses petrosæ; the internal occipital spine; the crucial tubercle, and two lateral cristæ.

181. Of the internal cavities, one is simple, the bottom of the sella sphenoidalis, called *fossa pituitaria*.

pituitaria. The rest are compound, viz. eight large fossæ in the basis of the scull, two anterior, two middle; and on the backside two upper, and two lower; the grooves of the superior longitudinal and of the lateral sinusses, and the sulci of the arteries of the dura mater.

182. The external inequalities are two large semicircular planes surrounding the temples, one on each side; the edge or circumference of which begins by a sort of crista or spine above the external angle of the orbit, and ends in two arches, one on the foreside, the other on the backside of the mastoide process; two occipital arches, one superior, the other inferior, which are both divided into two portions by the occipital crista or spine; the external vestiges of the sutures, &c.

External inequalities.

183. The internal inequalities are the undulated impressions in the basis of the scull; the internal vestiges of the sutures, &c.

Internal inequalities.

184. The compact or solid substance of the bones of the scull, is called *table*, of which one is external, and another internal, called also the *vitreous table*, as being more brittle than the former, because it is of a more close texture.

Substance.

185. The spongy or cellulous substance between the two tables, is named *diploë*, the quantity of which is proportionable to the thickness of the bones. In some places it is wanting, and there the tables uniting, are something transparent, as in the temporal bones, &c. In the internal table there are several considerable depressions, some of them near a quarter of an inch in depth, which run in through the *diploë*, and even reach the outer table. These depressions deserve to be taken notice of in relation to the operation of trepanning.

186. By the situation of the head in particular, I understand the natural posture of it, when a man stands, or sits, without inclining his head either backwards or forwards, to one side or the other, or drawing it down upon the neck or shoulders. Particular regard ought to be had to this situation in examining the head, either in general or in particular; and especially in considering the lower parts of the basis of the scull, and arch of the palate.

Situation in particular.

187. The common method of shewing these parts in a scull turned upside down, has often occasioned even expert anatomists to mistake the upper parts for the lower, and the lower for the upper. Therefore it is very necessary for beginners often to hold the skeleton of a head raised, in its true posture, and to view it from below upwards, that they may frame to themselves a just idea of it.

188. In order to this, whether the head be held in our hands, or set upon any thing else, the best way I have as yet hit upon, is to place the two zygomatic arches in a plane exactly parallel to the horizon. An head divided into two equal lateral parts, is likewise of great use in determining the true situation of the parts I have mentioned, and of those that lie near them.

Connection. 189. The connection of the head with the trunk is by ginglymus; the condyloide processes of the Os Occipitis, being received in the superior cavities of the first vertebræ of the neck. The connection of the particular bones of the head with each other is partly by diarthrosis, as in the articulation of the lower jaw; partly by synarthrosis, which obtains in the articulation of all the other bones, as shall be shewn hereafter.

Uses. 190. The principal uses of the bones of the head are to contain the brain, to be the seat of the organs of sensation, and to serve for mastication, respiration, the voice, &c.

§ 2. *The bones of the scull in particular, and first, the Os Frontis.*

191. The eight principal bones of the scull are ordinarily divided into common and proper. By proper bones, anatomists mean those which are wholly employed in forming the globe of the scull; and of these they reckon six, the Os Frontis, two Parietal Bones, the Occipital Bone, and two Ossa Temporum. The common bones are those which contribute to form the face as well as the scull, viz. the Os Ethmoides, and Os Sphenoides.

192. This division is not just; for the Os Frontis and Ossa Temporum deserve as much to be called common, as the two that are reckoned such; and thus, instead of six, there would

would be only three proper bones, the *Ossa Parietalia*, and *Os Occipitis*; and instead of two there would be five common ones; the *Os Frontis*, two *Ossa Temporum*, the *Os Ethmoides*, and *Os Sphenoides*.

193. The *Os Frontis* is situated in the anterior part of the skull, and forms that part of the face which is called the *forehead*, from whence it has its name. *Situation of the Os Frontis in general.*

194. Its figure is symmetrical, resembling a large shell almost round; so that two frontal bones of the same size joined together, represent one sort of shell fish pretty exactly. *Figure.*

195. Before we speak of the parts of this bone, we must take notice, that though it is always looked upon as one bone, it is sometimes found to be divided into two equal parts, by a continuation of the *sagittal* future, and this division is common to both sexes equally. *Division.*

196. When we consider it as one bone, it may be divided into an upper part, which belongs to the crown of the head; a lower part which belongs to the basis of the skull; an anterior part, which is the *forehead*; and two lateral parts, at which the temples begin. *Regions.*

197. It has two sides, one external, which forms the *forehead*, the greatest part of it being convex; and one internal, which is concave in proportion. By external I here mean what appears when the skull is entire; and by internal, what cannot be seen till the skull is opened.

198. On the outside we observe the following eminences; two *superciliary* arches, which form the upper edge of each orbit, or the *supercilia*; three *ridges* not always equally apparent, one between the two arches, and the other two above the arches, which may be called the *knobs* of the *forehead*; five *apophyses*, one at the extremities of each arch; one between the orbits which sustain the *Ossa Nasi*, and which in some subjects makes a part of the bony septum of the nose. This last I call the *nasal apophysis*, and the other four the *angular apophyses*. *External eminences.*

199. The external cavities are these; two *orbital* arches or vaults, forming the upper portions of the orbits; a remarkable depression in each of these vaults, above the external angle, which contains *External cavities.*

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the lachrymal gland : a small depression above the internal angle, to which is fixed the cartilaginous pulley of the great oblique muscle of the eye ; two portions of the temporal fossæ ; two little cristæ, which form the anterior extremity of the great semicircular plane of the temples on each side, at the edge of the superciliary arches, near the external angle ; two superciliary foramina, which are sometimes double, and sometimes only notches ; and lastly, two holes or portions of holes, called the *internal orbitary holes*.

200. On the inside of this bone we see a sharp perpendicular eminence, called the *frontal*, or *coronal spine*, directly opposite to the middle rising on the outside already mentioned ; above this spine

a portion of the groove for the longitudinal sinus, which, when the spine is wanting, runs down lower ; below the spine, a considerable opening, called the *ethmoidal opening*, because it contains the Os Ethmoides, the sides thereof are always more or less cellulous, Between this opening and the coronal spine, a blind hole which in some subjects is wholly in the Os Frontis, in others, common to that bone, and to the Os Ethmoides, and which seems to open into the frontal sinusses near the nose : the anterior fossæ of the basis of the skull, which receive the anterior lobes of the brain ; and which, by jutting out forwards, form the risings on the outside already taken notice of ; towards the lower part, they are uneven, answering the inequalities of the lobes, and they are also a little raised to make room for the orbits : sulci or furrows for the arteries of the dura mater, and sometimes indeterminate depressions, mentioned N^o 181. in the general account of the head.

201. This bone is composed, as has been already observed in general, of two tables and a diploë, except the orbitary vaults, which are very thin, and without any diploë. About the middle of the lower part of the bone, where the middle rising is commonly situated, the two tables are parted, to form two cavities, called the *frontal*, or *superciliary sinusses* ; and the separated portions are each of them in some measure composed of two tables, or at least have two surfaces, which makes in all four surfaces or tables.

202. The frontal sinusses are extended on the edge of the supercilia,

supercilia, on each side more or less, all the way to the superciliary perforations: below, they are open, and communicate with the cells of the Os Cribrosum. They are commonly parted by a bony septum, which is often more to one side than to the other, and more or less uneven. Sometimes it is perforated; and sometimes part of it, and sometimes the whole is wanting.

203. In different subjects, these sinusses are observed to vary extremely, both in respect of their extent, which in some is very small, and in respect of their form which is often very irregular, and their disposition cellulous. Sometimes they are entirely wanting, and in such subjects the internal cavity of the nose is larger than ordinary. It has likewise been remarked, that one of them does not open into the nose, but only communicates with the other.

204. To have a just idea of the true situation of all the parts of this bone, we ought, in examining or demonstrating it, to hold it in the same manner *Situation in particular.* as it is situated in an entire head, placed as has been already directed, No 188. For thus, we shall see that the upper part of it is a little inclined backward, and that its circumference or edges are in an inclined plane.

205. The Os Frontis is articulated by suture, with seven other bones; the Offa Parietalia, Os Ethmoides, *Connection.* Os Sphenoides, Offa Lachrymalia, Offa Nasi, Offa Maxillaria, and Offa Malarum.

206. It contains the anterior lobes of the brain, and a portion of the longitudinal sinus. It forms the forehead, *Uses.* the upper part of the orbits, and a portion of the temples.

§ 3. Offa Parietalia.

207. The parietal bones are two in number, one on each side, situated on the superior, lateral, and a little on the posterior parts of the skull.

208. They are of a larger extent than any other bone of the skull; their figure is nearly that of an irregular convex square. *Size and figure.*

209. They have each two sides, one external and convex, the other internal and concave; four edges, one *Parts.*

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superior or sagittal, one inferior or temporal, one anterior or frontal, and one posterior or occipital. The superior edge is the longest, the inferior the shortest, in which there is a very large squamous slope, which I name the *temporal slope*. The upper and posterior edges are indented through their whole length. The anterior edge is likewise indented, except at the lower part; all the lower edge is squamous, except a small part next the Os Occipitis.

210. It has four angles, the anterior and upper, the anterior and lower; the posterior and upper, the posterior and lower. The anterior and lower angle ends in a squamous production, which, from its situation, I call the *temporal angle*, or apophysis.

211. On the outside, above the temporal slope, we see the most considerable portion of the semicircular plane of the temporal muscle. Near the upper edge, towards the posterior angle, is a small hole called the *parietal hole*, which is sometimes found only in one of the bones, sometimes in the sagittal suture, and sometimes it is wanting. In some bones, it goes only to the diploë; in others, it perforates both tables.

212. The inside is something uneven, and many furrows are remarkable upon it, answering to the ramifications of the artery of the dura mater; the trunk of which is lodged sometimes in a groove, sometimes in a very short perfect canal, running through the substance of the bone near the anterior and lower angle. Near that, another such canal is sometimes, though rarely, met with, for another artery of the dura mater.

213. Along the upper edge of this inside, we see one half of the sagittal groove for the longitudinal sinus; and at the posterior and lower angle we meet generally with a small portion of another groove for the lateral sinus. Lastly, the same sort of irregular indeterminate depressions are sometimes observable in this bone, which we took notice of in the Os Frontis.

214. These bones are the weakest of the eight that compose the skull. The diploë is found between the tables, *Substance.* through the whole length of the sagittal and occipital edges; and through the upper half of the coronal edge.

215. To place or demonstrate this bone in its true situation, *Situation in particular.* we need only observe what has been said concerning its edges and angles, No. 209. 210. remembering

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ing only that the posterior and lower angle reaches farther down than the anterior.

216. Each parietal bone is joined to that on the other side, by the sagittal future; to the Os Frontis, by the coronal future; to the Os Occipitis, by the lambdoidal future; and to the Offa Temporum and Os Sphenoides, by the squamous future. *Connection.*

217. Its connection with the Os Frontis, below the semicircular plane, is by the squamous future, and the same is to be said of its articulation with the sphenoidal bone, as well as with the Offa Temporum. The squamous portions of the Os Frontis are covered by those of the Offa Parietalia; the squamous slopes in these last are covered by the Offa Temporum; and the squamous apophysis of the Offa Temporum is covered by a process of the Os Sphenoides.

218. These bones contain a large portion of the brain, form part of the temples, serve for the insertion of the tempotal muscles, &c. *Uses.*

§ 4. Os Occipitis.

219. The occipital bone is situated in the posterior and lower part of the cranium. *Situation in general.*

220. It represents a kind of lozenge irregularly indented, and yet symmetrical, convex on the outside and concave on the other. It consists very rarely of two pieces divided by the continuation of the sagittal future. *Figure.*

221. It consists of an external and internal side; of the upper, lower, lateral, and middle parts (the first four of which may be looked upon as so many angles) of four edges, two superior which are indented, and two inferior, which are more or less unequal. *Division.*

222. The outside is convex, near the middle of which the occipital protuberance or rising is observable. Under this protuberance are two superficial transverse arches, more remarkable in some subjects than in others; one superior and largest, the other inferior and least, and both reaching to the mastoide process on each side. The inferior arch is cut at right angles by a perpendicular line called the *external occipital spine*, or *crista*. Under the superior arch are two rough planes, one on each side of the spine; and between the extremities

termities of the two arches, are two other such planes, one on the right hand, the other on the left. We see likewise two condyles or condyloide apophyses crufted over with cartilages, gently convex, of an oblong oval figure, and situated obliquely, their posterior extremities being at a greater distance from each other than the anterior: also a large cuneiform production, which, from the condyles, is directed upwards, and in adults is often joined inseparably to the Os Sphenoides; it may be termed *apophysis basilaris*, or the great apophysis of the occipital bone. Lastly, some unequal tubercles on the lower part of this apophysis, and two little angular productions in the edge of the bone over-against the condyles.

223. We are likewise to take notice of two large notches under the lateral angles, which receive the posterior apophyses of the *Ossa Temporum*, two small notches or portions of the jugular fossæ, and of the foramina lacera; each of which is often divided by a small bony production: the great occipital hole, on the interior edge of which there is an impression for the insertion of a ligament: two anterior and two posterior condyloide fossulæ: two anterior condyloide holes for the ninth pair of nerves, which are sometimes double: two posterior condyloide holes for small veins, which are sometimes wanting.

224. The inside of this bone is concave, and there we are to take notice of a crucial groove, the edges of which are a little raised; the upper branch contains part of the great longitudinal sinus of the dura mater, the lateral branches receive the lateral sinusses, and the lower branch is oftener a spine or crista, than a groove: it is situated opposite to the external spine, and may be called the *internal occipital spine*. It happens often that the groove for the longitudinal sinus is more to one side than to the other. We see also the place where these grooves cross each other: a considerable tubercle opposite to the external protuberance: four fossæ separated by the four branches of the crucial groove, two of which contain the posterior lobes of the brain, and the other two, the cerebellum: a very broad groove in the apophysis cuneiformis, for the medulla oblongata, &c. two small portions of grooves lower down, which complete the grooves for the lateral sinusses of the dura mater. Along the inner edge of the

the large occipital hole, there is a kind of groove more or less sensible.

225. The upper part of this bone is very thick, as being much exposed to blows; the lower part of it is thin, but well guarded by muscles. The thickest part of the whole bone is at the occipital protuberance, between which and the tubercle of the crucial groove, there is a large quantity of diploë. *Substance.*

226. To set the occipital bone in its true situation, the great foramen is to be turned downward, and placed horizontally; the apophysis cuneiformis, forward and a little raised. *Situation in particular.*

227. This bone is joined on the upper part, to the *Ossa Parietalia*, by the lambdoidal suture, on the lower and lateral parts, to the *Ossa Temporum* by the continuation of the lambdoidal suture; on the lower and anterior part, to the *Os Sphenoides*, by the apophysis cuneiformis, both which in adults make commonly but one bone. It is likewise joined by a kind of suture to the supernumerary bones, when there are any such. *Connection.*

228. The *Os Occipitis* forms the back part of the head; serves for the articulation of the head with the trunk; contains a part of the brain, and almost all the cerebellum; gives passage to the medulla oblongata, and to a great many vessels and nerves; gives insertion to a great many muscles, &c. *Uses.*

§ 5. *Os Sphenoides.*

229. The sphenoidal bone is situated in the lower part of the cranium, a little toward the fore-part, making the middle of the basis of the skull, from whence it got the name of *Os Basilare*. It is called *sphenoides* or *cuneiforme*, because it is in a manner wedged in between the other bones. *Situation in general.*

230. It is of a very odd figure, and yet symmetrical. Its greatest extent is transverse, and it may in some measure be said to represent a bat, with its wings spread. *Figure.*

231. It consists of a great number of parts. The posterior and thickest part, by which it is joined to the apophysis of the *Os Occipitis*, may be called its body. *Division.*

The rest is wholly made up of eminences and cavities; and in order to examine these methodically, the bones must first be divided into two sides, one external, the greatest part of which may be seen in an entire skull; the other internal, which does not appear till the skull is opened.

233. The eminences on the outside are these: two temporal apophyses, which are the largest of all the processes of this bone, and at the greatest distance from each other; called by Ingrassias the great wings of the Os Sphenoides, and they are sometimes, though very rarely, separated from the rest of the bone by transverse sutures: two orbital apophyses, which form a considerable portion of the orbit, next the temples: a small sharp process shaped like a bird's bill, in the middle space between the two orbital apophyses: two pterygoide apophyses, each of which is divided into two alæ, one external, which is the largest, the other internal, the lower end of which is in the shape of a hook. Each ala is again divided into two sides, one external, towards the temples, and one internal, towards the palate: two spinal apophyses, a little anterior eminence above the sharp process, for the articulation of this bone with the Os Ethmoides. In some subjects, instead of this eminence there is a little notch.

233. The external cavities are as follow: two portions of the temporal fossæ: two portions of the orbital fossæ: two pterygoide fossæ, the lower ends of which are divided by an irregular notch or slit, which may be termed *fissura palatina*: a little oblong fossula at the root of the internal alæ: two superior orbital or sphenoidal fissures: a little notch at the end of each fissure, for the passage of an artery of the dura mater; two temporal notches: two maxillary notches, the edges of which help to form the inferior orbital fissures, which I call *fissuræ sphenomaxillares*; these edges are likewise sometimes considerably grooved: two holes for the superior maxillary nerves: two other holes on one side of the former, called *pterygoide*, which in an entire skull are hid by other bones: two oval holes for the inferior maxillary nerves: two little round holes, called *spinal holes*, each of which transmits an artery of the dura mater; sometimes they are only notches: another little hole between the two maxillary holes: a little groove on one side of

of the spinal apophysis, which forms part of the Eustachian tube.

234. The internal eminences are two thin sharp transverse apophyses, which form the superior orbital fissures, called by Ingrassias the little wings of the sphenoidal bone; a little process in some subjects in the middle space, between these thin apophyses, for the articulation with the Os Ethmoides, which in other subjects is a notch: four clynoide apophyses, two anterior, and two posterior; which last are sometimes united in one, and sometimes they run forward all the way to the anterior processes, forming a kind of bridge, under which the internal carotide artery passes at its last curvature; this passage has likewise been found divided in two by a middle bony septum, besides many other varieties: one or two small productions, where the internal carotide enters the cranium: two little styloide processes or hooks, which in some subjects join the extremity of the Os Occipitis, before the perfect union of these two bones.

Eminences on the inside.

235. The internal cavities are: two portions of the large middle fossæ of the basis cranii; two superior orbital or sphenoidal fissures: two optic holes: a small superior orbital hole, near the end of each sphenoidal fissure, which is often no more than a notch: a small groove at the extremities of the same fissures: a depression between the clynoide apophyses, called *sella sphenoidalis*, *sella turcica*, and *fossa pituitaria*. We see likewise almost all the holes taken notice of in the outside, and in particular, that the superior maxillary hole ought more justly to be called a *short canal*.

Cavities on the inside.

236. Besides the cavities hitherto mentioned, there are two very considerable ones, called the *sphenoidal sinusses*, situated in the thick portion of this bone, under the anterior part of the sella turcica and middle space, between the two optic holes, reaching as far as the sharp process or bill already described; they are commonly divided by a bony septum, and they open before, on each side of the sharp process, just behind the superior conchæ of the nose or *Ossa Convoluta superiora*. Their figure, size, openings, and septum, vary considerably; sometimes one of them is wanting, sometimes one opens only into the other; sometimes they are both wanting.

wanting; sometimes there are several cells without any septum, and sometimes the septum is placed more to one side than to the other.

237. The substance of this bone is compact for the greatest part, having very little diploë, and what diploë there is, lies in distinct parts of the bone, viz. in the thick portion behind the sella turcica towards the symphysis with the occipital bone, and in the orbitary apophyses in a small quantity.

Situation in particular. 238. To situate the sphenoidal bone aright, the sella turcica must be turned upward, the sharp process forward, and the pterygoide apophyses downward.

Connection. 239. It is articulated with all the other bones of the cranium, with the *Ossa Malarum*, *Ossa Maxillaria*, *Ossa Palati*, and *Vomer*.

Uses. 240. The uses have all been mentioned in the course of the description.

§ 6. *Os Ethmoides.*

Situation in general. 241. The *Os Ethmoides* is situated interiorly in the fore-part of the basis cranii

Figure. 242. The figure of the whole bone taken together is very particular; it may be said, however, in some measure to be cubical.

253. The divisions of this bone are perfectly arbitrary; that which I make choice of is into a middle and two lateral portions; in the middle portion I distinguish three parts, an upper, middle, and lower.

Division. 244. The upper part of the middle portion is an eminence, called *crista galli*, which is often solid; sometimes, however, it has been found hollow in several degrees, and perforated by a small opening, which communicates with the frontal sinusses: a groove is sometimes met with in its anterior edge, which leads to the spinal or blind hole in the *Os Frontis*.

245. The middle part of this portion is a small horizontal plate perforated by several holes, called *lamina cribrosa*, and in the back-part it has a little notch for its articulation with the sphenoidal bone. This lamina may be reckoned the body

dy of the bone, as being what principally supports all the other parts thereof.

246. The lower part is a perpendicular lamina, which makes part of the septum narium. Its edge is rough and uneven for its better connection with the vomer.

247. The lateral portions of the ethmoidal bone are by far the most considerable, if we regard the size only. I divide each of them in two, one superior, which is the largest, and which I term the labyrinth of the nostrils, it being full of turnings and windings, and irregularly cellulous; and one inferior in the shape of a shell.

248. The labyrinth has four sides and two ends. The upper side is partly covered by the cells of the frontal sinus, and large opening already described. The lower side is partly joined to the cells of the Os Maxillare, and partly left exposed and free; it sends backward several productions more or less considerable, which in skeletons are often broken. These productions sometimes join the root of the sharp process in the sphenoidal bone, being there fixed in lateral grooves. The inside is something convex and rough; it is turned toward the septum, and fixed only to the edge of the lamina cribrosa. The outside is flattened and very smooth, from whence it got the name of *Os Planum*; it makes part of the inside of the orbit, and at its upper edge there are often one or two small notches, parts of the internal orbitary holes already mentioned in the description of the Os Frontis.

249. The anterior extremity of the labyrinth is unequally cellulous; it is partly covered by the cellulæ in the large opening of the Os Frontis, and partly by the Os Unguis; and by a kind of funnel it communicates with the frontal sinus. The posterior extremity is covered partly by the sphenoidal bone, and partly by the Os Palati.

250. The inferior part of each lateral portion resembles in some measure an oblong shell, such as that of a muscle. I give it the name of *concha narium superior*, or upper shell of the nostrils. It is very rough and porous, its convex side being towards the septum, and the concave side towards the Os Maxillare. One end of it is turned backward, the other forward, and there the upper part of it joins the labyrinth, by means of the tunnel already mentioned. This inferior part

part is distinguished from the superior or labyrinth, by a remarkable lateral groove.

Situation in particular. 251. What has been said is sufficient to direct us in situating this bone, remembering only that the head of the crista galli ought to be turned forward.

Substance. 251. It is of a very delicate and tender structure, though compact and without any diploë, being almost all composed of very thin bony plates.

Connection. 253. It is joined to the Os Frontis, Os Sphenoides, Offa Nasi, Offa Maxillaria, Offa Unguis, Offa Palati, and Vomer.

Uses. 254. The uses of it are to be a principal part of the organ of smell, and to give a very great extent to the pituitary membrane in a small compass, &c.

§ 7. *Offa Temporum.*

Number and situation in general. 255. The Offa Temporum are two in number, situated in the lower and lateral parts of the skull.

Figure. 256. The figure of each is partly semicircular, resembling the scale of a fish, partly like a shapeless rock ending in several points.

Division. 257. Each of them is divided into two portions, one superior termed *squammæus* from its figure; the other inferior, called *apophysis petrosa*, or the *rock*, not so much from its figure as from its hardness. This portion is easily separable from the former in children, and some marks of this division still remain in adults, as Riolan has observed.

258. They are likewise divided into two sides, one external and convex, the other internal and concave; and thus the eminences and cavities in them may likewise be divided into external and internal.

External eminences. 259. The external eminences are the mastoide apophysis in the lower and posterior part of the bone: the zygomatic apophysis in the anterior part: the styloide apophysis under the bone, which seems originally to have been an epiphysis. In one subject I saw this apophysis three inches in length; and in another, a styloide appendix joined to the ordinary apophysis by a ligament, and stretched

stretched along the stylo-pharingæus muscle: the capsular apophysis in which the bony stilet seems as it were to be set: the articular eminence of the zygomatic apophysis: the lambdoidal angle; the lower side of the apophysis petrosa.

260. The external cavities are the articular cavity immediately behind the eminence so called, which both together serve for the articulation of the lower jaw; the crack in the articular cavities: the mastoide notch or groove in which the digastric muscle is inserted: the opening of the external meatus auditorius; the anterior indented border of that opening: the stylo-mastoide or anterior mastoide hole, which is the orifice of the passage of the portio dura of the auditory nerve: Fallopius termed this passage the aqueduct, not because of its use, but because of the resemblance it bears to a kind of aqueduct in his country: the orifice or inferior hole of the carotide canal in the apophysis petrosa, which alters its direction upward and forward, and ends at the point of the rock near the sella sphenoidalis: a portion of the jugular fossa, and a portion of the foramen lacerum.

External cavities.

261. Among the external cavities, we are likewise to reckon a portion of the ductus palatinus of the ear, called commonly *tuba Eustachiana*, and in France the *aqueduct*. This duct, which must not be confounded with the aqueduct of Fallopius, follows pretty much the direction of the articular crack: the zygomatic notch: the parietal notch, which receives the posterior and lower angle of the Os Parietale: the sphenoidal notch, which receives the spinal apophysis of the Os Sphenoides; one or more little sulci for the ramifications of the temporal artery; the groove in the apophysis petrosa, by which it is connected to the great apophysis of the Os Occipitis. We may likewise add the posterior mastoide hole, through which a small vein passes, that empties itself into the lateral sinus: this hole is sometimes formed between this bone and the Os Occipitis, sometimes it is wanting in one of the bones, and sometimes in both. There is likewise in some subjects, a small superior mastoide hole, which loses itself in the substance of the bone.

262. In examining the internal eminences and cavities, we must distinguish the squamous portion from the apophysis petrosa. In the former

Internal eminences and cavities.

we see the radiated indentations of the semicircular edge, which, with the parietal bone, forms the squamous suture; a portion of the middle fossa of the basis cranii on the same side, and several inequalities in that fossa.

263. The apophysis petrosa or rock, is a sort of pyramidal body with three sides situated obliquely, so as that its basis is turned backward and outward, and its apex forward and inward towards the sella turcica. Of the three sides, one is superior and inclined a little forward; the second posterior, and the third inferior: this last belongs to the outside of the whole bone, which has been already described.

264. The upper side assists in forming the middle fossa of the basis cranii, being uneven in the same manner as the inside of the squamous portion. We observe here a small irregular hole appearing to be double, and partly covered by a small bony plate. This hole is a kind of break or interruption in the duct, through which the portio dura of the auditory nerve passes.

265. In the backside of the rock we see the internal auditory hole, and a portion of the fossa for the cerebellum. Sometimes small indeterminate depressions are observable in it, pretty deep in children, but gradually obliterated as they advance in years. At the basis of this apophysis we see a portion of the groove for the lateral sinus, formed partly in this basis, and partly in the lambdoidal angle; also a portion of the foramen lacerum; and a small point, which, as it were, divides this hole in two, and distinguishes the passage of the jugular vein, from that of the eighth pair of nerves.

266. As this apophysis has three sides, so we may observe in it three angles; the first superior between the upper and back sides; the second posterior, between the back and lower sides; and the third anterior, between the lower and fore side. The superior angle, which is the most apparent, has a groove for a small sinus of the dura mater; the posterior angle is in a manner interrupted near the middle by the foramen lacerum, and from it proceeds the little bony point which divides this hole. At the end of it is a groove, by which it is connected with the great apophysis of the Os Occipitis. Between the apex of the apophysis petrosa and the superior opening of the carotide canal, we often meet with a small

a small bone of the sesamoidal kind, mentioned long ago by Riolan.

267. To set any one of the *Ossa Temporum* in its true situation, the zygomatic apophysis must be placed horizontally and turned forward, and the mastoide process directly downward. *Situation in particular.*

268. Almost the whole substance of the *Ossa Temporum* is compact. The squamous portion is thin and transparent. The mastoide apophysis is hollowed by considerable cells. The substance of the apophysis petrosa is very hard and solid, with several internal cavities for the organ of hearing contained in it. *Substance.*

269. Each *Os Temporis* is joined above, to the *Os Parietale* by a squamous suture, behind and below, to the Occipital bone, partly by a true suture, and partly by harmony; before to the great alæ of the *Os Sphenoides*, by a squamous suture, and below to the spinal apophyses of that bone. It is likewise joined before, to the *Os Malæ* by the zygomatic suture. *Connection.*

370. The chief uses of these bones are to complete the globe of the skull, to serve for the articulation of the lower jaw, and for the insertion of many muscles, and lastly to contain the organ of hearing. *Uses.*

N. B. The description of the bones of the ear, and of the supernumerary bones of the skull, is placed immediately after that of all the other bones of the head.

§ 8. *The bones of the face; and first, the Ossa Maxillaria.*

271. I shall only add here, to what has been said about these bones in general, in the enumeration of the parts of the skeleton, that the *Ossa Palati*, *Vomer*, *Conchæ Narium inferiores*, and *Ossa Unguis*, are very improperly said to belong to the face, except we chuse to look upon them as concerned in the internal structure of the nose, which is undoubtedly a part of the face.

272. The *Ossa Maxillaria*, or great bones of the upper jaw, are two in number, situated one on each side, in the anterior and middle part of the face. *Number and situation of the Ossa Maxillaria.*

273. Their conformation is very irregular, and they
Figure. are of a very considerable extent.

274. Each of them may be divided into two sides, one external, the other internal. By the external side, I
Division. mean all that appears in an entire skull, without taking in the arch of the palate; and by the internal side, that which makes part of the arch of the palate, and all that is turned to the septum narium.

275. The external eminences are the nasal apophysis, which makes the lateral part of the nose; the orbitary apophysis, which makes the inferior portion of the cavity of the orbit, and by a sort of crista forms the internal portion of its edge; this process is likewise called *apophysis malaris*, because of its connection with the *Os Malæ*: the apophysis palatina, which together with that on the other side, forms the arch of the palate; the apophysis alveolaris, which is in the shape of an arch, and contains the teeth: the maxillary tubercle, or the posterior extremity of the last named arch; the spine of the nares, which is a small pointed eminence above the anterior extremity of the apophysis alveolaris.

276. The external cavities are these: a portion of the orbitary fossa, where there is a small fossula, in which
External cavities. the interior oblique muscle of the eye is inserted, near the lachrymal duct, and a fissure or crack, of which hereafter: a portion of the zygomatic fossa: a portion of the fossa palatina, or arch of the palate, in which many little inequalities are observable, more or less pointed, and often little pointed hooks.

277. Also the lachrymal opening, which receives the *Os Unguis*: a small lachrymal groove, which together with the *Os Unguis* forms the superior part of the lachrymal duct; the opening of the nares; a portion of the inferior orbitary fissure, or *fissura spheno maxillaris*; the opening which receives the *Os Palati*; a very small notch at the anterior extremity of the arch of the palate, which forms the anterior foramen incisivum, so called from its situation behind the incisors; an oblique groove in the posterior part of the maxillary tubercle, which contributes to the formation of the posterior foramen maxillare.

278. Also the orbitary canal, which runs from before, backward

ward immediately under the inferior portion of the orbit; an anterior orbitary hole, or the anterior orifice of the orbitary canal: the posterior orbitary hole, or the posterior orifice of the orbitary canal, by which that canal ends at the edge of the sphenomaxillary fissure: the crack or fissure of the orbitary canal, which appears more or less in the orbit, and is often a little open backward: the small holes of the maxillary tubercle. The small holes near the orbitary canal and those of the apophysis nasalis, vary and are sometimes wanting. The sockets shall be described hereafter.

279. The internal eminences and cavities are as follow: the greatest part of the fossa nasalis; the anterior crista of the nares, which is high and narrow; the posterior crista of the nares, which is low and broad, these two cristæ are a continuation of the spine of the nares, N^o 275. and are so disposed as to form a long groove for the reception of the septum narium, when the two maxillary bones are joined together: a perpendicular and pretty hollow groove, wide towards the upper part, narrow towards the lower, which makes the inferior portion of the lachrymal duct.

Internaleminences and cavities.

280 Also the anterior ductus palatinus on one side of the anterior crista, and near the spine of the nares; this duct in its course downwards, joins that of the other jaw, and both together form the anterior foramen palatinum, or incisorium, which is often very complex: a small anterior eminence or transverse line, between the nasal opening, and the lower end of the lachrymal duct, which sustains the fore part of the concha narium inferior: a rough broad impression on the maxillary tubercle, on both sides of the passage of the foramen palatinum, by which this bone is joined with the Os Palati; a small posterior eminence or transverse line, covered with a lamina of the Os Palati, which sustains the inequalities of the posterior end of the concha narium inferior, by the intervention of a lamina of the Os Palati, as we shall see afterwards.

281. Lastly, the maxillary sinus, which is a large cavity under the orbit, in the orbitary apophysis. It extends to the suture of the Os Maxillæ, to the sphenomaxillary-fissure, to the inferior orbitary hole, and below to the sockets. Towards its upper edge, there are sometimes cells, which communicate with the Os Ethmoides. It opens between the two conchæ narium;

narium, behind the lachrymal duct, by one or more orifices, formed partly by a portion of the Os Palati, partly by a portion of the concha narium inferior, and sometimes partly by a portion of the Os Unguis. These openings are all much higher than the bottom of the sinus.

282. I say nothing here of the separation of this bone by a small transverse suture, behind the foramen incisarium; because it is seldom found but in young subjects before the ossification is completed.

283. The maxillary bone is almost all compact, and without diploë, except in the alveolar arch, and at the point of the orbitary apophysis.

Situation in particular. 284. To put this bone in its true situation, the nasal apophysis must be turned upwards, the alveolar arch downward, and the spine of the nares forward.

285. The maxillary bones are connected with the Os Frontis, Os Ethmoides, Os Sphenoides, Offa Unguis, Offa Malarum, Offa Nasi, Offa Palati, Vomer, conchæ narium inferiores, and with each other.

Uses. 296. They assist in forming the organ of mastication, the arch of the palate, the cheeks, the orbits, the nose, &c.

§ 9. Offa Malarum.

Number and situation in general. 287. The Offa Malarum, called also Offa Zygomatica, and Malaria, are two in number, situated in the lateral and middle parts of the face.

Figure. 288. They are in some measure triangular, or irregularly square.

Division. 289. They are divided into two sides, the external gently convex, the internal unequally concave.

Eminences. 290. The eminences in each bone are the superior or angular orbitary apophysis, which joins by suture with the external angular apophysis of the Os Frontis, and assists in forming the external angle of the orbit: from this apophysis another subaltern process runs inward on the inside of the bone, one side of which forms a portion of the orbit; the other, a portion of the zygomatic fossa; the inferior or maxillary orbitary apophysis, which, with the angular apophysis, forms the inferior external portion

on of the orbit: the apophysis malaris, which is in some measure the basis of the rest, and together with the apophysis maxillaris, joins the orbitary apophysis of the Os Maxillare: the zygomatic apophysis, which makes a part of the zygoma, and also of the zygomatic fossa.

291. The cavities are the great orbitary slope, which makes the inferior external portion of the edge of the zygomatic notch above the zygoma: one or more little holes on the outside and in the orbitary apophyses. *Cavities.*

292. Each bone is composed of two pretty compact tables, with a small quantity of diploë between them, except in the anterior part of the apophysis malaris. *Substance.*

293. The true situation will be easily fixed, by considering what has been said about the sides and apophysis of this bone. *Situation in particular.*

294. The Os Malæ on each side is joined to the Os Frontis by the angular apophysis, to the Os Sphenoides by the subaltern apophysis, to the Os Temporis by the zygomatic apophysis, and to the Os Maxillare by its basis. *Connection.*

295. These bones make the prominent upper part of the cheeks, most remarkable in lean persons. They form likewise a portion of the orbit, and complete the zygomatic arches. *Uses.*

§ 10. *Ossa Nasi.*

296. The proper bones of the nose are two in number, joined together, and situated below the forehead, between the two nasal apophysis of the Ossa Maxillaria. *Number and situation.*

297. Each of these bones comes near the figure of an oblong square, the upper extremity being narrow and thick, the lower oblique and thin; the middle part bent inwards near the upper end in some subjects, in others almost straight. The two bones joined represent a sort of saddle. *Figure.*

298. Each of them is divided into two sides, one anterior or external, the other posterior or internal; two extremities, one upper, the other lower; and two edges, one external, the other internal. *Division.*

299. The

299. The anterior side is convex, though a little depressed or hollowed above the middle. The posterior side is gently concave. The upper extremity is very thick, full of points and depressions. The lower extremity is thin, unequally indented, and cut obliquely in such a manner, as that the two bones, joined together, form an acute slope. The inner edge contiguous to the same edge of the other bone, is even, except near the upper part, where they are united by a kind of future. From this edge, a little eminence runs inward or backward, (which is sometimes wanting in one of the bones); and when they are joined, these eminences represent a sort of crista or prominent line, answering to the septum narium. About the middle of the outside, sometimes higher, sometimes lower, there is a hole, which is sometimes wanting in one of the bones, and sometimes there are several holes in each.

Substance. 300. The substance is compact, sometimes however we meet with a small quantity of diploë at the upper end.

Situation in particular. 301. The particular situation of these bones is easily understood by the description.

302. They are joined to each other, partly by future, and partly by harmony. They are joined above to the nasal apophysis of the Os Frontis, laterally to the nasal apophyses of the Os Maxillaria, and interiorly or posteriorly to the anterior edge of the perpendicular lamina of the Os Ethmoides, by means of the prominent line already mentioned.

Uses. 303. They form the anterior and upper portion of the nose, and part of the septum narium.

§ 11. *Ossa Unguis.*

Number, situation and size. 304. The Ossa Unguis or Lachrymalia are two in number, each being situated in the orbit, at the lower part of the internal angle. They are the least bones of the face, very thin and transparent.

305. They are longer than they are broad, resembling in some measure the nail of a finger, (from whence they have their name), especially when in situ;
for

for being taken out of the scull, their figure is more irregular.

306. Each of them is divided into two sides, one external, the greatest part of which appears in the orbit, in an entire scull, the other internal, which is hid; two extremities, one upper, the other lower, and two edges, one anterior, the other posterior. *Division.*

307. The outside is smooth, and a little concave. Towards the anterior edge, is a groove full of small holes, like a sieve, called the *lachrymal groove*. It begins at the upper extremity, and runs down lower than any other part of this side of the bone, the lower extremity of it being hid by the Os Maxillare. It is distinguished from the rest of the outside, by a very sharp prominent edge.

308. The inside is rough and unequally convex, with a perpendicular depression, answering to the sharp prominence on the outside. On the upper part of this inside, small portions of cellulous laminæ are sometimes observable, which communicate with the entry of the frontal sinus. There are likewise some about the middle, which complete the anterior ethmoidal cells; and others towards the lower end, which communicate with the rugged portions of the upper border of the sinus maxillaris. These often vary, and are sometimes wanting.

309. These bones are altogether without diploë. *Substance.*

310. What has been said about the two sides and lachrymal groove, sufficiently determines the situation. *Situation in particular.*

311. They are connected with the Os Frontis, with the Os Ethmoides, covering a part of the cells in that bone, with the nasal apophysis of the Os Maxillare, and with the groove of that bone, in such a manner, as that the two grooves joined together form an entire tube, called the *lachrymal duct*. They also cover a little the opening of the maxillary sinusses, and join the inferior conchæ of the nares, of which they appear to be only a continuation in an advanced age. *Connection.*

312. The uses of them are to complete the internal sides of the orbit, to cover the forepart of the labyrinth of the nose, and to form the lachrymal duct. *Uses.*

§ 12. *Offa Palati.*

313. The bones of the palate are two, situated in the posterior part of the arch of the palate, between the pterygoide apophyses, and the *Offa Maxillaria*, and running up on the sides of the nasal fossæ, all the way to the bottom of each orbit.

Number and situation in general.

314. The figure of these bones is not square, as is said by those who have only seen that portion of them which belongs to the palate, and from thence have named them *Offa Palati*. The entire bone is crooked, hooked, pointed, and uneven, though but of a small size.

Figure.

315 Each of them may be divided into four portions, one superior, one middle, and two lower; whereof one is anterior, the other posterior.

Division.

316. The lower and anterior portion, which I call *portio palatina*, is the basis or body of the bone, and the only part of it which the ancient anatomists have observed, *Vidus Vidi* excepted. It completes the arch of the palate, and the bottom of the nasal fossa. The inner edge of it is raised, and that joined to the like edge of the other bone, forms a groove, which receives part of the septum narium, in the same manner, as the other part of it is received in a like groove of the *Offa Maxillaria*. The posterior edge is gently sloped, and ends inwardly in a point which joins a like point in the other bone.

317. The lower and posterior portion, which I name *pterygoide*, is pointed and hollowed on each side, to join the pterygoide apophysis, of which it completes the fossa, being fixed like a wedge in the irregular notch of that process. Exteriously it is uneven, the better to be connected with the *Os Maxillare*. This portion is distinguished from the *portio palatina*, and also from the middle portion, by an oblique half-canal, which, with the half-canal in the maxillary tubercle, forms an entire canal, the lower end of which is the posterior foramen palatinum.

318. The middle portion to which I give the name of *nasal*, is very thin, and is situated laterally. It has an internal and external side. The internal side is a little concave, being turned toward the nares, and at the lower part of it there

is a transverse eminence or bony line which distinguishes this portion from the portio palatina. The outside is a little convex, and partly covers the opening of the maxillary sinus. At the lower part of it, is a transverse groove, answering to the eminence on the other side, and moulded, as it were, by the posterior transverse eminence of the Os Maxillare.

319. The upper portion, which I call *orbitaly*, is distinguished from the nasal portion, by a notch, which, together with the pterygoide apophysis of the sphenoidal bone, forms an opening more or less considerable; which may be called *foramen speno-palatinum*, or *pterygo-palatinum*. This portion has five little sides, three of which are rather cavities; one superior, which completes the extremity at the bottom of the orbit, and is more or less flat, very small, smooth, and triangular; one anterior, which is a little hollow, covering the upper part of the maxillary tubercle, and by a smooth raised edge completing the fissura speno-maxillaris; the third side is likewise anterior, more hollow than the former, joining the back part of the labyrinth of the Os Ethmoides: the fourth is posterior, more or less hollow, answering to the sphenoidal sinus: the fifth is lateral and external, covering the posterior and upper part of the maxillary sinus. It must be observed, that these sides and cavities vary, being sometimes single, sometimes complex.

320. There is very little diploë in these bones, except in the palatin and pterygoide portions.

Substance.

321. By considering the division of these bones already mentioned, it is easy to put them in their true situation.

Situation in particular.

322. They are joined to each other by the portio palatina, to the vomer by the common groove formed by their raised edges, to the maxillary bones before, and laterally, to the sphenoidal bone behind, to the inferior shells of the nares, by their transverse eminences; and lastly by their orbitaly portions to the Os Ethmoides, Offa Maxillaria, and Os Sphenoides.

Connection.

323. They complete the arch of the palate, the pterygoide and nasal rostræ, and the orbit; they assist in supporting the vomer and conchæ narium inferiores.

Uses.

§ 13. *Vomer.**Situation in general.*

324. The situation of the vomer is perpendicular between the two nasal fossæ backward.

Figure.

325. The figure of it is nearly that of an oblique square, having some resemblance to a ploughshare, from which it has its name.

Division.

326. It is divided into two sides, one to the right, the other to the left, both of them unequally flat; and into four edges, the superior, inferior, anterior, and posterior.

327. The upper edge is an horizontal groove which receives the sharp process or rostrum of the Os Sphenoides. This groove is broad and a little notched backward; the forepart of it is narrower, and ends in a strait canal, which runs downward and forward in an oblique direction, dividing the bone, as it were, into two laminæ.

328. The anterior edge is oblique and very unequal. It may be divided into two parts, one anterior, the other posterior. The posterior part is small and thin, and supports the perpendicular lamina of the Os Ethmoides. The anterior part is larger, with a pretty deep groove, continued from the canal in the upper edge, which sustains the cartilaginous septum of the nares.

329. The lower edge is likewise unequal, and near its anterior extremity, is an angle which divides it into two parts; one anterior, very short, which is set in the crista narium; the other posterior and much longer, set in the common groove of the Offa Maxillaria and Palati. The angle by which this edge is divided lies in the notch formed by the crista narium and the groove of the maxillary bones.

330. The posterior edge is oblique and sharp, becoming insensibly more obtuse as it approaches to the large groove in the upper edge.

Substance.

331. This bone has but very little diploë.

Situation in particular.

332. To situate it right, we need only attend to the description of its parts.

Connection.

333. It is connected with the Os Sphenoides, Os Ethmoides, Offa Maxillaria, and Offa Palati in the manner already said.

334. Its

334. Its use is to form the posterior part of the *Ufe.*
septum narium.

§ 14. *Conchæ Narium inferiores.*

335. The inferior shells of the nares are two in number, situated in the nasal fossa, under the openings of the maxillary sinus, and immediately above the inferior orifices of the lachrymal ducts. They cover these orifices much in the same manner as the superior conchæ of the ethmoidal bone cover the maxillary openings. They are likewise termed *the inferior spungy laminae of the nose.*

336. Their figure is very much like that of the superior shells. *Figure.*

337. Two sides are distinguishable in each of them, one internal, and one external; as likewise two extremities, the anterior and posterior; three edges two superior, one small, the other great, and one inferior; and, lastly, two apophyses, one small or superior, the other large or lateral. *Division.*

338. The inside is gently convex, being turned towards the septum narium; the outside is proportionably concave, turned towards the maxillary sinus. Both sides are rough and uneven.

339. The extremities are pointed, but the posterior more than the anterior.

340. The inferior edge, the most considerable of the three, is rough, thick, a little rounded and turned outward, that is, toward the Os Maxillare. It is suspended like the ethmoidal concha, without resting on any thing.

341. The small or anterior upper edge is thin, uneven, and of the same length with the anterior transverse eminence of the Os Maxillare to which it is joined. The large or posterior upper edge is longer than the other, and is joined backward to the small transverse eminence of the middle portion of the Os Palati. These two superior edges are distinguished by an obtuse angle formed by them. The great edge is a large thin apophysis in shape of a nail, which runs down on the inner or concave side of the bone. This apophysis, which is the greatest of the two already mentioned, is sometimes smooth, sometimes uneven, divided and notched.

ed. It partly covers the maxillary sinus, and helps to make the opening thereof.

342. The small or superior apophysis, is a thin plate, which divides the two upper edges, It is, as it were, a small portion of a groove, which, joined to the lower end of that in the Os Unguis, completes the lachrymal canal, and in adults it has appeared to be a true continuation of the last named bone, as if the inferior concha of the nares and Os Unguis were both one piece.

Situation in particular. 343. The true situation of these bones is sufficiently shewn in what has been said about their sides, extremities, and edges.

Connection. 344. They are connected with the *Ossa Maxillaria*, *Ossa Palati*, *Ossa Unguis*, and sometimes with the *Ossa Ethmoides*, of which they appeared in one subject to be a true continuation. In most skeletons, these connections are but very slender, and therefore these bones are easily lost, which is the reason why the ancients have not observed them.

Uses. 345. They complete the bony structure of the nose, augment its surface, and render it proportionable to the extent of the organ of smell, and of the pituitary membrane.

§ 15. *Maxilla Inferior.*

Situation in general. 346. The lower jaw is but one bone in adults, and makes the lower part of the face, being situated there.

Figure. 347. It bears some resemblance to a bow, with the ends bent upwards.

Division. 348. It may be divided into a body and branches. The body is that portion which represents a bow: the branches are the extremities bent upward. In the body, we distinguish an anterior portion, called the *chin*, two lateral portions; two sides, one internal, and one external; and two edges, one superior, which is the alveolar arch of this jaw, and one inferior, called the *basis*, and divided into an external and internal labium. This basis ends posteriorly in a crooked portion, termed *the angle of the lower jaw*.

349. In the middle of the anterior side of the chin is a perpendicular

pendicular eminence or line which marks the place where this bone is divided in children, and, for that reason, named *the symphysis of the lower jaw*. On each side of the symphysis, are two muscular impressions, one high, the other low, more or less excavated, and in some subjects distinguished by a small transverse eminence. The external labium of the basis of the chin is a little prominent, and bordered on each side by eminences more or less considerable, by which the chin appears to be distinguished from the lateral parts of the body of the bone.

350. The backside of the chin is concave, and inequalities are seen in it, through the whole length of the symphysis. From the upper edge, to the middle of the symphysis, or thereabouts, runs a superficial asperity, broader below than above, and more remarkable in the symphysis, than on either side. Immediately below this asperity, there are several tuberosities more or less raised and rough, the lowest of which is on the internal labium of the basis. On each side of the uppermost tuberosity, is a large shallow impression. At the very lowest border of the internal labium of the basis, on each side of the symphysis, there is a pretty large muscular impression, with a transverse asperity between them, which in a manner joins them to each other. We sometimes meet with small holes in the upper part of the symphysis, and near it.

351. The outside of each lateral portion of the body of the bone is a little convex. On each side of the chin is a pretty large hole, which is the anterior orifice of a canal hereafter to be described. There is also a long eminence or elevation, which beginning at the basis, near the forementioned hole, runs obliquely upward and backward toward the branch of the jaw, growing more prominent as it ascends. The lower edge of this side sometimes juts out a little.

352. In the inside of this lateral portion, a little below the alveolar edge, there is likewise a long eminence, less oblique, but more prominent, which runs upward and backward, much in the same manner with that on the outside.

353. The posterior curve portions are the flattest of all, and represent a sort of oblong square, irregular, and a little oblique. In each of these branches, two sides are to be taken notice of, one internal and one external; also two apophyses in the upper part of them, one anterior, called the *coronoide apophysis*, and one posterior, called the *condyloide apophysis*; a large

large opening between the two apophyses; and lastly, an angle by which the posterior and lower part or basis of the branch is terminated.

354. The anterior or coronoide apophysis is flat, sharp at the upper end, broad at the lower, something uneven on the outside, and a little prominent about the middle of the inside, by the continuation of the internal oblong eminence of the lateral portion. The anterior edge of this apophysis is a continuation of the oblique external eminence of the same portion.

355. The posterior apophysis is termed *condyloide*, because it ends in a head resembling a condyle, set upon a kind of neck. This condyle is oblong, and situated almost transversely, the internal extremity of it being only turned a little backward, and the external forward, which direction answers to that of the articular eminence and cavity of the Os Temporis, with which this condyle is articulated. It advances more toward the inside than toward the outside of the bone, and the neck is bent a little forward. This neck is convex on the back-part, and on the fore-part there is a muscular fossula immediately under the condyle.

356. The great opening between the apophyses has a sharp border, which is, as it were, a continuation of the posterior edge of the coronoide apophysis, it is in the shape of a crescent, and ends at the outer extremity of the condyle on the outside of the fossula in its neck.

357. The outside of the branch is very full of superficial inequalities or muscular impressions, especially near the angle. This angle is blunt, uneven, and turned more or less toward the outside.

358. The inside has the same sort of inequalities towards the angle. About the middle of this side is a very irregular hole, being the internal orifice of a large canal, which, after having run down a little way in the middle substance of the branch, changes its direction, continuing its course through the middle of the lateral portion, all the way to the hole near the chin, which is its external orifice, and then loses itself in the substance of the chin. The internal orifice of this canal is broad above, oblique, flat, more or less notched, and in some measure lacerated. A little below this orifice are sometimes found two little holes, one above, and at some distance
from

from the other; which are the orifices of a very small canal running immediately under the surface of the bone. This canal is the continuation of a small groove, which begins at the edge of the orifice of the great canal, and from thence runs a very little way down. In some subjects, we find only this groove without any canal.

359. The upper edge of the body of the lower jaw is pierced by sixteen holes and fossulæ, called *sockets*, which contain the like number of bones, called *teeth*; both which I shall describe together.

360. This bone appears to have a larger share of diploë in proportion to its size, than any other bone of the face, especially near the alveolar arch. The tables are very solid, and not equally thick in all parts. *Substance.*

361. There is no difficulty in determining the situation of the lower jaw. *Situation in particular.*

362. The lower jaw is connected with the *Ossa Temporum* by a very singular kind of articulation, partaking of the nature both of a ginglymus and arthrodia, and therefore I term it *amphidiarthrosis*. Its principal motions are upward and downward, and in all the different degrees thereof we can thrust it forward, pull it backward, and turn it to either side; and in the same manner, in any degree of motion forward, backward, or laterally we can raise or depress it. The mechanism of this articulation, and the motions thereof depend also on a cartilage, which not being found in the skeleton, the description of it must be referred to that of the fresh bones. *Connection.*

§ 16. *Dentes.*

363. The teeth are the hardest, most solid, and whitest parts of the whole skeleton.

364. In an adult person they are generally thirty-two in number, sixteen placed in the lower edge of the upper jaw, and sixteen in the upper edge of the lower jaw. They are all fixed in their sockets, like so many little wedges or stakes, the heads and points of which are different from each other. *Number, situation in general, and figure.*

365. The teeth in each jaw are divided into three classes;

Division and situation in particular. the first, including the four anterior teeth, called *incisores*; the second, including the two next, one on each side, named *canini*; and the third, including the other ten, five on each side, named *molars*.

366. In each tooth we distinguish two portions, one without the socket, called the *body of the tooth*, and in the dentes molares, the *crown*; the other within the socket, called the *root of the tooth*. These two portions are divided by a kind of circular line, which may be termed the *collar of the tooth*. When the teeth are in situ, the roots of the superior row are turned upward, the bodies downward; in the lower row, the roots are turned downward, and the bodies upward.

367. The incisors are so called from a Latin word, which signifies *to cut or divide*. They were likewise called formerly *dentes risorii*, because they appear in laughing. The four upper incisors are larger and broader than the four lower; and of the upper, the two in the middle are larger than the other two.

368. The bodies of these teeth resemble sharp cutting wedges, and their roots pointed wedges. The bodies are so disposed, as that their sharp edges lie all in a line, making one uniform edge. Each body has four sides, one anterior, a little convex; one posterior, a little concave; and two lateral, much narrower than the former, and almost flat. The anterior and posterior sides decrease in breadth towards the collar, the lateral sides towards the edge; so that they represent in some measure four triangles with their apices and bases reciprocally opposite.

369. These teeth have long roots; their lateral sides are broad and flat, the anterior and posterior sides narrow, and they terminate by degrees in a point, in which a small hole is observable, pretty considerable in children, but obliterated in old age.

370. The *dentes canini* are so termed, because they are naturally a little pointed, and appear longer than the rest, almost the same manner as in dogs. They might likewise be called *angular*, because they make a sort of angle by which the incisors are separated from the grinders. The two superior have also been named *eye-teeth* from their situation.

371. The bodies of them are thicker and more prominent than

than the incisors, convex and a little rounded on the outside, and ending in a short triangular point, one of the sides of which is a continuation of the convexity of the outside, the other two are flatter and turned inwards. These points are often worn out by mastication. The roots are commonly larger, thicker, longer, and more pointed, than those of the incisors, and sometimes perforate the bottom of the maxillary sinus.

372. The *dentes molares* are so called, because they serve as so many mills to grind the food. They are generally twenty in number, five placed on each side of both jaws; immediately after the canini. The two first in each row are small, the two next larger; as is also the last, which appears very late, and is often wanting; and from thence the molares have been distinguished into small grinders, large grinders, and *dentes sapientiae*, because they seldom appear till men arrive at the years of discretion.

373. Their bodies in general are short, very thick, irregularly cylindrical, or rather with four sides a little rounded, and terminated by a broad end more or less filled with obtuse points cut, in some measure, like so many diamonds. The name of *crown* is most frequently given to the bodies of these teeth, the resemblance being greater than in the others.

374. In the two small molares, the crown is less than in the others, and often not so large as the bodies of the canini: they have commonly but two points: though sometimes the second appears to have three. In the two large molares, the crown has a much greater extent, and the points are three, four, or five in number. The fifth grinder, or *dens sapientiae*, has a crown much like the two former, but often more rounded and with fewer points.

375. The roots of the molares are long and more or less flat; single in some of them, in others, two, three, four, but rarely five in number. Sometimes all these roots are distinct, sometimes wholly united, and sometimes united only in part. They are generally straight, and at a greater distance from each other at the extremities, than at the crown of the tooth.

376. The roots of the small grinders appear often single without being so in reality; for in examining them narrowly, we find they have two roots, united, or, as it were, soldered together

together. Sometimes all the distinction that appears is in two separate points.

377. The great molares have commonly several roots; the first three, and the second four; or the first four, and the second sometimes five; but these numbers are variable. These roots are sometimes all perfectly distinct; sometimes they are partly distinct, and partly united in the same tooth, in different degrees. In some subjects one or more of their points are bent outward, inward, or in other directions; and we do not always meet with more roots in the upper teeth than in the lower.

378. The fifth grinder has often but one root, sometimes very short, and sometimes very long. We meet with this tooth even in grown persons almost wholly hid in its socket, which has then but a very small opening. Lastly, it ought to be remarked concerning all the molares, that, near the collar, their roots unite in a sort of trunk.

379. In an adult person, the teeth in general, are very compact and solid. A very narrow cavity goes from the body to the point of the root, where it ends in a small hole, which at length perhaps becomes imperceptible, and even quite disappears. But to be more particular, the outer substance of the teeth is different from the inner; and that of the body from that of the root.

380. The bodies of the teeth are crufted over with a substance much harder than the rest, naturally very white, polished, and shining, looking like the imperfect vitrification of china-ware, or like enamelling; and nothing can destroy it but the file or corrosive liquors. It may be called the *enamel of the teeth*. The roots have some small share of it, but not near so much as the bodies.

381. When viewed through a microscope, this substance appears to be made up of short fibres, the radiated extremities of which are turned both inwards and outwards. The inner substance of the teeth is the same with that of the other bones, only harder than any of them, except the apophysis petrosa of the Os Temporis.

382. The teeth are connected with the sockets in both jaws by an articulation without motion, called *gomphosis*. They are fixed in the sockets like pins or nails, their roots being exactly surrounded by the
spongy

spongy substance or diploë; and appearing like moulds for the cavities of the sockets, which are rather porous *vaginæ* than spongy *fossulæ*. The trunk of the root is surrounded by the common orifice of the socket, at a small distance from the circular line or collar. The upper and lower teeth meet in such a manner, as that the first, and especially the incisors, advance most forward and run over the latter, the arch of the lower teeth appearing to be smaller than that of the upper.

383. In general, the teeth serve for mastication or chewing. In particular, the incisores tear and cut the food; the canini break it to pieces, and the molares bruise and grind it. The teeth, especially the incisores, contribute, likewise, to the articulation of sounds. *Uses.*

§ 17. *Os Hyoides.*

384. The *Os Hyoides* or bone of the tongue is situated in the middle space between the angles of the lower jaw. It is a little bone, and resembles, in some measure, the basis of the lower jaw, or a small bow. The ancient Greeks compared it to one of the vowels in their language, and from thence came the name of *Os Hyoides*, *Yoides*, or *Ypsiloides*. *Situation in general and figure.*

385. It is distinguished into the basis, which is the anterior part; two large cornua, which are the lateral parts, and two small cornua, or appendices, which are the superior parts, to the upper end of which other appendices are frequently joined. *Division.*

386. The basis is the broadest and thickest part. It is situated transversely, and two sides may be distinguished in it, one anterior, unequally convex, and one posterior, unequally concave: it has likewise two edges, one superior, and one inferior; and two extremities, one to the right, and one to the left. The angles of it might likewise be distinguished.

387. In the middle of the fore-side is a perpendicular eminence, which divides it into right and left portions, and which terminates above in a small pointed tubercle, with a small hollow impression on each side. At the lower end of this eminence there are also two such impressions, but much larger. Near each extremity we find inequalities, which end

in

in the angles of the basis. The backside, as has been already said, is hollow.

388. The large cornua are joined to the extremities of the basis by cartilaginous symphysis, which in adults become long. In each cornu we distinguish the root, or anterior extremity, the point, or posterior extremity, and the middle portion. The length of each cornu is near double that of the basis. The roots are thick and broad, and by them the cornua are joined to the basis. The lower part of the middle portion is a little crooked, and also broader than the rest. The points end in a little cartilaginous head; and in the natural state, a short ligament with a little round bone or cartilage, runs down from each of these heads, as we shall see in examining the fresh bones.

389. The small cornua are placed on the symphyses of the large ones, almost perpendicularly, being only inclined a little outward and backward. They are joined by a cartilaginous symphysis peculiar to them; and are themselves cartilages in young people, but they afterwards ossify, though not always at the same age, and at last their symphyses are lost. The length of these cornua varies pretty much; and at the upper extremity of each of them, we sometimes meet with one or more additional portions, in the shape of little oblong pearls, or of little pillars set upon one another, and held together by a kind of ligament more or less cartilaginous, of which hereafter. The substance of these appendices is different in different ages, in the same manner as that of the cornua themselves.

390. The connection of the Os Hyoides, not being by articulation, does not belong to the description of the skeleton, and therefore must be referred to the account of the fresh bones, and of the tongue. It will be sufficient to observe here, that it is connected by a ligamentary symphysis with the styloide apophysis, the cartilago thyroides of the trachea arteria, and the epiglottis: it is also connected by muscles, with other parts, as we shall see hereafter.

391. The chief use of this bone is to be the basis and support of the tongue. The pliability of the small cornua are likewise believed to contribute to the perfection of singing.

§ 18. *The bony parts of the organ of hearing.*

392. All the bony parts of the organ of hearing, or bones of the internal ear, being contained in the inferior portions of the *Offa Temporum*; it will be very proper to recollect what has been already said about these, N^o 255. &c. and especially to consider well the particular situation of the apophysis petrosa, its basis, apex, and sides, and also of the mastoide apophysis, with the eminences, cavities, holes, &c. which lie thereabouts.

Situation in general.

393. All the bony organ of hearing may very naturally be divided into four general parts: 1. The external meatus auditorius; 2. The tympanum, or barrel of the ear; 3. The labyrinth; 4. The internal meatus auditorius. It may likewise be divided into immoveable or containing parts, which take in all the four already mentioned; and moveable or contained parts, which are four little bones lodged in the tympanum, called *incus*, *malleus*, *stapes*, and *Os Orbiculare* or *Lenticulare*.

394. The external auditory passage begins by the external auditory hole, the edge of which is rough and prominent; but backwards towards the mastoide apophysis it appears very much sloped. The passage itself is about half an inch in length, running obliquely from behind forward, in a curve direction, and sometimes winding a little in the middle, like a screw. Its cavity is almost oval, wider at the entry than at the middle, after which it widens again by degrees.

External meatus auditorius.

395. It terminates inwardly by an even circular edge lying in a plane very much inclined, the upper part of it being turned outward, and the lower part inward; so that the whole canal is longer on the lower side than on the upper. The concave side of the circular edge is grooved quite round.

396. In children this bony canal is wanting, as well as the mastoide apophysis; and the inner circular edge is a distinct ring, which, in an advanced age, unites entirely, and becomes one piece with the rest. It is termed the bony circle in infants, and indeed it is very easily separated from all the other parts.

397. It would seem therefore that the whole bony canal in

in adults is only a prolongation of the bony circle in children; because even in a more advanced age, the whole canal may without much difficulty be taken out. The circular groove lies between the mastoide apophysis and the articular fissure or crack.

398. The tympanum or barrel of the ear is a cavity irregularly semispherical, the bottom of it being turned inward, and the mouth joined to the circular groove already mentioned. Both eminences and cavities are observable in it.

399. The remarkable eminences are three in number; a large tuberosity lying in the very bottom of the barrel, a little toward the back part; and a small irregular pyramid situated above the tuberosity, and a little more backward; the apex of it is perforated by a small hole, and on one side of the basis, two small bony filaments are often found in a parallel situation, and indeed, I believe they are seldom wanting, though their tender structure exposes them to be often broken: in the third eminence is a cavity shaped like the mouth of a spoon, situated at the upper and a little towards the anterior part of the bottom of the tympanum. This cavity is part of a half-canal, of which hereafter; and at a very small distance from its point is a little bony ridge which goes from one edge of it to the other, but is sometimes not entire.

400. The principal cavities in the tympanum are, the opening of the mastoide cells or sinuosities; the opening of the Eustachian tube; the bony half-canal; the fenestra ovalis and rotunda; and to these may be added the small hole in the pyramid.

401. The opening of the mastoide cells is at the posterior and upper part of the edge of the barrel. The cells themselves which end there are dug in the substance of the mastoide process, being very irregular and full of windings and turnings.

402. The opening of the Eustachian tube is at the anterior and a little toward the upper part of the edge of the barrel. This tube, in France generally termed the *aqueduct*, runs from the tympanum, towards the posterior openings of the nasal fossæ, and arch of the palate. The bony portion thereof, of which alone I here speak, is dug in the apophysis

sis petrosa along the duct of the carotide apophysis, and when it leaves that, it is lengthened out by the spinal apophysis of the Os Sphenoides. These two cavities, the mastoide cells, and the Eustachian tube, are, in some measure, prolongations of the tympanum, one anterior, the other posterior.

403. The bony half canal, of which the cavity resembling the mouth of a spoon is the extremity, lies immediately above the Eustachian tube, towards the upper side of the apophysis petrosa, or rather in the very substance of that upper side. In a natural state, a small muscle is lodged in it.

404. The fenestra ovalis is a hole of communication between the tympanum and labyrinth. It lies immediately above the tuberosity, the upper side of it being a little rounded, the lower a little flatted; and one extremity being turned forward, the other backward. Towards the labyrinth, this opening has a little flat thin border quite round it, which renders it narrower at that place than any where else.

405. The fenestra rotunda is something less than the ovalis, and situated in the lower and a little towards the posterior part of the large tuberosity; the opening of it, which is the orifice of a particular duct in the labyrinth, lying obliquely backward and outward.

406. The hole in the apex of the pyramid is the orifice of a cavity which may be named the sinus of this pyramid.

407. The tympanum contains several little bones, called the *bones of the ear*. They are generally four in number, denominated from something to which they are thought to bear a resemblance, viz. Incus, Malleus, Stapes, and Os Orbiculare or Lenticulare. *Officula auditus.*

408. The incus or anvil resembles, in some measure, one of the anterior grinders with its roots at a great distance from each other; at least it comes nearer to this than to the shape of an anvil. It may be divided into a body and branches. The body is a large substance, the branches or legs are two, one long and one short. The body is turned forward, the short leg backward, and the long leg downward. *Incus.*

409. The body of the incus is broader than it is thick. It has two eminences, and two cavities between them, much in the same manner as we see in the crown of the first grinders.

410. The short leg is thick at its origin, and from thence decreasing gradually, it ends in a point. It is situated horizontally, its point being turned backward, and joined to the edge of the mastoid opening of the tympanum.

411. The long leg viewed through the external auditory passage, appears to be situated vertically; but if we look upon it either on the fore or back side, we see it is inclined, the extremity of it being turned much more inward than the root or origin. The point of the extremity is a little flattened, and bent inward like a hook, and sometimes a little hollowed like a kind of ear-picker. By this we may distinguish the incus of one ear from that of the other, when out of their places; for, turning the short leg backward and the long leg downward, if the curvature of this long leg be toward the left hand, the bone belongs to the right ear; if towards the right, it belongs to the left ear.

412. The malleus or hammer is a long bone, with a large head, a small neck, an handle, and two apophyses, one in the neck, the other in the handle.

413. The top of the head is considerably rounded, and from thence it contracts all the way to the neck. Both head and neck are in an inclined situation, and the eminences and cavities in it answer to those in the body of the incus.

414. The handle is looked upon by some, as one of the apophyses of the malleus: and in that case, it is the greatest of the three. It forms an angle with the neck and head, near which it is something broad and flat, and decreases gradually toward its extremity.

415. The apophysis of the handle, termed by others, the small or short apophysis of the malleus, terminates the angle already mentioned, being extended towards the neck, and lying in a straight line with that side or border of the handle which is next it.

416. The apophysis of the neck, called also *apophysis gracilis*, is in a natural state very long, but so slender withal, that it is very easily broken, especially when dry; which is the reason why the true length of it was for a long time unknown. It arises from the neck, and sometimes appears much longer than it really is, by the addition of a small dried tendon sticking to it.

417. When the malleus is in its true situation, the head
and

and neck are turned upwards and inwards, the handle downwards, parallel to the long leg of the incus, but more forward; the apophysis of the handle upwards and outward, near the superior portion of the edge of the tympanum, near the center of which is the extremity of the handle, and the apophysis gracilis forward, reaching all the way to the articular fissure in the Os Temporis. It is easy, after what has been said, to distinguish the malleus of the right side from that of the left.

418. The stapes is a small bone, very well denominated from the resemblance it bears to a stirrup. It is divided into the head, legs, and basis. *Stapes.*

419. The head is placed upon a short flatted neck, the top of it being sometimes flat, sometimes a little hollow.

420. The two legs taken together, form an arch, like that of a stirrup, in the concave side of which is a groove, which runs through their whole length. One leg is longer, more bent, and a little broader than the other.

421. The basis resembles that of a stirrup, both in its oval shape, and union with the legs, except that it is not perforated as the stirrups now are, but solid, like those of the ancients. Round its circumference, next the legs, is a little border which makes that side of the basis appear a little hollow. The other side is pretty smooth, and one half of the circumference is something more curve than the other.

422. The subject being in an erect posture, the stapes is to be considered as lying on its side, with the head turned outward, near the extremity of the leg of the incus; the basis, inward, being fixed in the fenestra ovalis; the longest leg, backward; the shortest forward, and both in the same plane. By this situation, it is easy to know the stapes belonging to each ear.

423. The orbicular or lenticular bone is the smallest bone in the body. It lies between the head of the stapes and extremity of the long leg of the incus, being articulated with each of these. In dry bones it is found very closely connected, sometimes to the stapes, sometimes to the incus; and might in that state be easily mistaken for an epiphysis of either of these bones. *Os orbiculare.*

424. The labyrinth is divided into three parts, the anterior, middle, and posterior. The mid- *Labyrinth.*

dle portion is termed *vestibulum*, the anterior, *cochlea*, and the posterior, the *labyrinth in particular*, which comprehends the three semi-circular canals.

425. It is proper here to call to mind the true situation and direction of the apophysis petrosa. This being supposed, the cochlea lies forward and inward, towards the extremity of the apophysis; the semicircular canals, backward and outward, toward the basis of the apophysis, and the vestibulum between the other two.

426. The vestibulum is an irregularly round cavity, less than the tympanum, and situated more inward and *Vestibulum.* a little more forward. These two cavities are, in a manner, set back to back, with a common partition-wall between them, perforated near the middle by the fenestra ovalis, by which the cavities communicate with one another.

427. The cavity of the vestibulum is likewise perforated by several other holes; on the outside or towards the tympanum, by the fenestra rotunda, but this is commonly seen in dry bones only; on the backside, by the five orifices of the semicircular canals; on the lower part of the foreside, by two holes which are the entry of the cochlea, but one of them is shut up in fresh bones; and on the foreside, towards the internal meatus auditorius, opposite to the fenestra ovalis, by a great many very small holes for the passage of the nerves. On the upper side there are only small pores.

428. The semicircular canals are three in number, one vertical and superior, one vertical and posterior, and one horizontal. *Semicircular canals.* The superior vertical canal is situated transversely with respect to the apophysis petrosa, the convex side or curvature of it being turned upward, and the extremities downward, one inward, the other outward. The posterior verticle canal lies parallel to the length of the apophysis, the curvature being turned backward, and the extremities forward, one upward, the other downward; and the superior extremity of this canal meets and loses itself in the internal extremity of the former. The curvature and extremities of the horizontal canal are almost on a level; the curvature lying obliquely backward, and the extremities forward, ending under those of the superior vertical canal, but a little nearer each other; and

and the inner being almost in the middle space, between the extremities of the posterior vertical canal.

429. The horizontal canal is generally the least of the three, the posterior vertical is often, and the superior vertical sometimes, the greatest; and sometimes these two are equal. All the three canals are larger than a semicircle, forming nearly three quadrants; they are broader at the orifices than in the middle. These orifices open into the backside of the vestibulum, as has been said, being but five in number, because two of them are lost in each other, N^o 428; so that in the posterior part of the vestibulum, two appear towards the inside, and three towards the outside.

430. In children, the substance of these canals is compact, while that which surrounds them is spongy, so that they may be easily separated from the rest of the apophysis petrosa. In adults, all the parts of the bone are so solid, that these canals appear only like passages dug in a piece of ivory. From this description it is easy to distinguish the right labyrinth from the left.

431. The cochlea is a sort of spiral shell, with two ducts, formed in the anterior part of the apophysis petrosa, in some measure resembling the shell of a snail. The *Cochlea.* parts to be distinguished in it, in its true situation, are the basis, the apex, the spiral lamina or half septum, by which its cavity is divided into two half canals, the spindle round which the cochlea turns, and, lastly, the orifices and union of the two ducts.

432. The basis is turned directly inward, toward the internal foramen auditorium, the apex outward, and the axis of the spindle is nearly horizontal: but in all of them allowance must be made for the obliquity of the Os Petrosum in which they lie.

433. The basis of the cochlea is gently hollowed, and, towards the middle, perforated by several small holes. The spindle is a kind of short cone, with a very large basis, which is the middle of the basis of the cochlea. Through its whole length runs a double spiral groove, which, through a microscope, shews a great number of pores.

434. The Cochlea makes about two turns and an half from the basis to the apex; and the two ducts being strictly united together through their whole course, from an entire common septum,

septum, which must not be confounded with the half septum or spiral lamina, as is often done. The first might be termed the *common septum*, the other the *particular septum*, or *half-septum*.

435. Both of them are closely joined to the spindle, being thicker there than in any other place. The common septum is complete, and separates the turns entirely from each other, whereas the half-septum in the skeleton is only a spiral lamina, the breadth of which is terminated all round by a very thin border lying in the middle cavity of the cochlea. In the natural state there is a membranous half-septum, which completes the partition between the two ducts, as we shall see in describing the fresh bones.

436. The two half-canals turn jointly about the spindle, one being situated towards the basis of the cochlea, the other towards the apex: for which reason I have always termed one of them *internal*, the other *external*; the division of them into the upper and lower flight, not being agreeable to the natural state, but liable to convey a very false idea thereof.

437. The spiral or volute of the cochlea begins at the lower part of the vestibulum, runs from thence forward to the top, then backward down to the bottom, afterwards upwards and forward, and so on from the basis which is turned inward, to the apex which is turned outward.

438. From this description it is easy to know to what ear any cochlea belongs when we see it prepared. It likewise teaches us, that in the right cochlea, the direction of the turnings is the same as in garden-snails, and almost all the other common shells; but in the left cochlea, the turnings are in a contrary direction, as in one kind of shell, which is rarely met with.

439. The two half-canals communicate fully at the apex of the cochlea. Their separate openings are towards the basis, one of them being immediately into the lower part of the fore-side of the vestibulum, the other into the fenestra rotunda. These two openings are separated by a particular turning, which shall be explained in describing the organ of hearing.

440. The internal auditory hole is in the backside of the apophysis petrosa, in some measure behind the vestibulum, and basis of the cochlea. It is a kind of blind hole, divided into two fossulae, one large, the

Foramen auditorium internum.

the

the other small. The large one lies lowest, and serves for the portio mollis of the auditory nerve or seventh pair. The small one is uppermost, and is the opening of a small duct, through which the portio dura of the same nerve passes.

441. The inferior fossula is full of little holes, which, in the natural state, are filled with nervous filaments of the portio mollis, which go to the spindle, to the semicircular canals, and to those of the cochlea. It is this fossula which forms the shallow cavity at the basis of the spindle of the cochlea.

442. The passage for the portia dura of the auditory nerve runs behind the tympanum, and its orifice is the stylo-mastoide hole. Fallopius gave to this duct the name of *aqueduct* from its resemblance to some aqueducts in Italy. It begins by the small fossula, and pierces from within outwards, the upper part of the apophysis petrosa, making there an angle or curvature. From thence it is inclined backward, behind the small pyramid of the tympanum, and runs down to the stylo-mastoide hole, through which it goes out, and is distributed in the manner we shall see in the description of the nerves. It communicates likewise by a small hole, with the sinus of the pyramid, and lower down by another hole with the barrel of the ear.

443. In some skulls this aqueduct of Fallopius is open on the upper part of the apophysis petrosa, a kind of break appearing in it, formed by a double hole. It is at this place that it makes the angle already mentioned. But commonly it is covered with a bony lamina.

§ 19. *The supernumerary bones of the head.*

444. I call by the name of supernumerary bones, several pieces found in some skulls, chiefly between the parietal and occipital bones. They form breaks in the lambdoidal future, and are joined by true futures to the bones already mentioned.

445. Their figure, number, and sizes, vary very much. They are sometimes in some measure triangular, but oftener of no regular figure. In some subjects they inroach on the occipital bone, in others on the parietal bones, and sometimes they extend themselves every way. They are commonly indented,

dented, and broader on the outside of the skull than on the inside, in which they are without any visible indentations; and sometimes are scarcely to be seen, when they are small on the outside.

446. They have been termed *keys*, a name given by joiners to the pieces which serve to strengthen the joints of boards; but which can agree to them only in respect to their situation, and not in respect to their uses in the cranium or other bones of the head. They may serve to multiply the ordinary futures, &c.

447. Some such bones have likewise been found in the joints between the bones of the head and face; and between those of the bones of the face with each other; and to these might be added the supernumerary teeth placed out of the rank of the rest.

A R T. III.

The bones of the trunk.

448. **T**HE trunk comprehends all the bones, which in a natural state lie between the head and the four great extremities. These bones are divided into three parts, the Spine, Thorax, and Pelvis; the first of which, that is, the spine, may be looked upon as a common part, the other two as proper.

§ 1. *The Spine and Vertebrae in general.*

Extent and situation in general.

449. By the spine is meant all that order of bones which follow one another without interruption, from the Os Occipitis, downward, along the posterior part of the trunk.

450. It represents a very compound folding pillar, round on the foreside, and on the backside stuck full of prickles or points, representing so many particular spines; having a canal in the middle, through its whole length into which a great number of holes open on each side. When it is viewed directly on the fore or back side, it appears straight and to be made up of different portions of pyramids in a contrary

Figure.

trary situation to each other; but viewed sidewise, it presents several different curvatures.

451. The pieces which form the spine, are of two kinds, one single, the other compound. The single pieces are generally twenty-four in number, called by the name *Division.* of *Vertebræ*; the compound pieces are two, the Os Sacrum and Os Coccygis; the single pieces are likewise called *true vertebræ*, to distinguish them from the portions which compose the other two, which are called *false vertebræ*.

452. The true vertebræ are divided into three classes, viz. seven vertebræ of the neck, twelve of the back, and five of the loins, to which are likewise given the names of *cervical, dorsal, and lumbar vertebræ*.

453. To have a clear idea of the structure and disposition of each vertebra, we must first examine what they have in common, and next what is peculiar to the vertebræ of each class, or to any particular vertebræ therein. Afterwards, the description of the portions which compose the Os Sacrum and Os Coccygis, will complete this first part of the trunk.

454. What is common to all the vertebræ, may be reduced to their external conformation, internal structure, connection and uses.

455. In the vertebræ in general, we are to consider the body, apophyses, and cavities. *External conformation and division of each vertebra.*

455. By the body of the vertebræ, we mean that principal part or large mass, situated anteriorly, and which supports all the other parts. In most of the vertebræ the body represents a portion of a cylinder cut transversely, the circumference of which is more or less round on the fore-part, and sloped on the back-part. It has two sides, the upper and lower, each of which is, as it were, bordered by a thin lamina in form of an epiphysis. *Body of the vertebra.*

457. The apophyses in most of the vertebræ are seven in number: one posterior, called the *spinal apophysis*, which ends in a small epiphysis, and has given the name to the whole system of the vertebræ; two lateral, called *transverse apophyses*; and four, which are likewise lateral, two on each side, one above, and one below. They are called by the general name of *oblique apophyses*, and distinguished into superior or ascending, and inferior or descending. These four *Apophyses.*

are the least of all the processes of the vertebræ, and each of them has a cartilaginous side. I should chuse to call them *articular* rather than *oblique apophyses*, for a reason which shall be afterwards given, and I sometimes name them likewise the *small apophyses* of the vertebræ.

458. The cavities in the vertebræ are these; a large middle hole, between the body and apophyses; four *Cavities.* notches, two on each side, one superior and small, and one inferior which is larger. The great foramen is part of the vertebral or spinal canal, and the notches of one vertebra meeting those in another, form the lateral holes, which communicate with the canal.

459. Though the situation of the vertebræ has been already *Situation in* mentioned pretty exactly, it will be proper to *particular.* repeat it again. The body is the anterior part of each vertebra: the spinal process, the posterior part; the transverse and oblique or articular processes are the lateral parts; and the great foramen is in the middle of all these parts.

460. The inner substance is spongy or like a di- *Internal* ploë covered with an outer compact substance, which *structure.* in the body of the vertebræ is very thin, but thicker in the processes.

461. The vertebræ are joined together by their bodies and *Connection.* by their small apophyses. The bodies in a natural state are principally united by a cartilaginous symphysis, that is, by the intervention of a pliable and elastic cartilage, as we shall see in describing the fresh bones. This cartilaginous connection makes the lateral holes of the spine larger in the body than in the skeleton, where these cartilages are wanting.

462. Their connection by the small apophyses, is by arthrodia, and not by ginglymus, as shall be afterwards shewn. These two articulations are secured by very strong ligaments, of which in another place.

§ 2. *Vertebræ of the neck.*

463. In most of the vertebræ of the neck, the body is a *The body.* little flattened anteriorly, and is thinner or shorter than that of all the other vertebræ of the spine. The upper

per side is a little concave, the lower proportionably convex. The breadth on the forepart increases gradually as they descend; so that taken all together, they represent a sort of pyramid. All that is here said is not to be extended to the two first vertebræ, nor to the seventh.

464. The spinal apophyses are more or less straitened, and forked at the extremity, except in the first vertebra, which has no such process. *Spinal processes.*

465. The transverse apophyses are for the most part very short, perforated perpendicularly, concave or grooved on the upper side, a little forked, and as it were, double, except in the first and last vertebræ, in which these apophyses are longer, and more pointed. *Transverse apophyses.*

466. The articular apophyses, except the first, are more oblique than in the other vertebræ, and their cartilaginous sides are inclined in such a manner as that, in each vertebra, the superior apophyses are turned backward and upward; the inferior forward and downward. Some particularities in the two first vertebræ are here likewise to be excepted. *Oblique apophyses.*

467. The first vertebra is called *atlas*, because it supports the head, as Atlas did the globe of the universe, according to the ancient fable. It is neither body nor spinal apophysis. The hole or opening in it is much larger than in the rest. It looks like an irregular bony ring filled all round with eminences and cavities. It may be divided into two arches: the anterior or largest, and posterior or smallest. *The first vertebra of the neck. head.*

468. The anterior arch is formed by two thick lateral portions, and a small curve middle part, which, with the other two, makes a notch in the anterior part of the great cavity of the vertebra. The lateral portions may be looked upon as a body in two parts, without which the first vertebra would have been too weak to sustain the articulations.

469. In the middle of the convex side of the posterior arch, is a tubercle a little pointed, larger than the anterior tubercle, and marked with muscular impressions on each side, and on the upper and lower edge. This tubercle seems to be in the place of a spinal apophysis.

470. The transverse apophyses of the first vertebra arise

from the middle of the breadth of the lateral portions, being perforated perpendicular at their broad origins. They are much longer than those of the five vertebræ below them, and contracting gradually, they terminate in an obtuse point, which is sometimes in a manner double, and marked on the upper and lower side with muscular impressions.

471. The superior articular apophyses are larger than any other apophyses of the same kind in the whole spine. They are oblong cartilaginous cavities framed in the upper side of the lateral portions. Their situation is almost horizontal, and their anterior extremities are turned more inward, that is, nearer one another than the posterior. They are, in a word, every way proportioned to the condyles of the Os Occipitis.

472. The inferior articular apophyses are less hollow, shorter, and broader. They are inclined laterally from within outwards, and from above downward. They are directly under the superior apophyses; and thus the articular and transverse apophyses, the holes and lateral portions on each side are all in the same line.

473. There is a long notch or kind of groove between each superior articular apophysis, and the posterior arch of the bony ring, reaching from the hole in the transverse apophysis backward: in which notch, the vertebral blood-vessels in the natural state make a turn, before they enter the great occipital foramen. Sometimes, though very rarely, there is a complete hole in the room of this groove. There is another notch, but more shallow, on each side, between this arch and the inferior apophyses.

474. In the internal circumference of the great hole of this vertebra, in the middle of the great notch, is a cartilaginous impression for the articulation of the axis of the second vertebra; and on each side of that notch, between the superior and inferior apophyses, there is another small impression for the insertion of a transverse ligament, which secures the axis in its place. All round this circumference, both towards its upper and lower edges, there are many other inequalities or impressions.

475. The second vertebra of the neck is very different from the first. Its body is narrower and longer than that of the following vertebræ; and

Second vertebra.

its

its length is increased on the upper part by an eminence like a pivot or axis, called by the Greeks *odontoides*, by the Latins *dentiformis*, or simply *dens*.

476. In this axis four impressions or marks are observable; one anterior which is cartilaginous, for its articulation by a like impression, with the great notch in the first vertebra; one posterior, for the insertion of the transverse ligament already mentioned; two superior, which unite at the point of the axis, and serve for the insertion of the ligaments by which the axis is fastened to the anterior edge of the occipital hole. The superior portion of the axis is a true epiphysis grafted upon a forked apophysis.

477. The spinal apophysis is short, broad, and very much forked, being distinguished into two lateral parts by a kind of angular crista. The lower side of it is hollow, and the cavity is angular, and divided into two lateral parts by a bony line.

478. The transverse apophyses are very short, a little inclined downward, and perforated obliquely; whereas in all the other vertebræ these perforations are perpendicular. When the apophyses are thin, this obliquity does not appear so much; but when they are thick, the hole is more like a true canal, bent in such a manner as that one orifice is downward, the other outward. The apophyses themselves end in a point turned downward.

479. The superior articular apophyses do not answer exactly to the inferior apophyses of the first vertebra. Their cartilaginous sides are inclined obliquely outward and downward; and as they are narrower than the former, and have their edges more raised toward the outside, a small empty space is commonly left between the two, on the fore and back parts, in the skeleton: the reason of which appearance shall be given in the history of the fresh bones. The superior apophyses of this vertebra, the transverse processes of the first and their holes are all in the same perpendicular line.

480. The inferior apophyses are less, and situated further back. Their cartilaginous sides are turned backward, and very obliquely, inclined from below, upward, and from before, backward; so that their situation is more vertical than horizontal. They are likewise a little hollow.

481. The superior notches are superficial, long, situated behind

behind the superior apophyses, and insensibly disappear toward the spinal apophyses. The inferior notches are situated more forward, directly under the transverse apophyses, and their holes. The body of this vertebra has a very small tubercle on the fore-side.

482. The conformation of the third vertebra of the neck is not very different from that of the vertebræ
Third vertebra. of the neck in general already described. The superior apophyses answer to the inferior apophyses of the second vertebra, their cartilaginous sides being a little convex and turned backward. The inferior apophyses are a little hollow and turned forward.

483. The transverse apophyses are very short, and placed before the articular ones. They are something forked and depressed on the upper side, between the lateral hole and the extremity. The notches are turned a little forward, above and below the transverse apophyses, and the lower are deeper than the upper.

484. The fourth, fifth, and sixth vertebræ are like the third, except that their bodies are gradually
Fourth, fifth, and sixth vertebra. more extended, but still hollow on the upper side, and convex on the lower; and that the spinal apophysis of the sixth vertebra is longer, thinner, and straighter than in the three above it. The inferior apophyses of the fourth and fifth vertebræ, and the superior of the sixth, are not so much inclined as those above them.

485. The body of the last vertebra of the neck is the largest of all, so that, as has been already said,
Seventh vertebra. all the seven represent a sort of pyramid set on the vertebral pillar of the back. The lower side of the body of this vertebra is almost flat. The spinal apophysis is long, almost straight, and very prominent, for which reason it has been termed *prominens* in Latin. It ends in a little flat head, sometimes smooth, and sometimes a little depressed or forked.

486. The transverse apophyses of this vertebra are longer, placed further back, and less grooved than the former. Their holes are sometimes double, and in that case, less than when they are single: and sometimes there is a break or opening in them like a notch, which variety is also observable in the sixth vertebra.

487. The

487. The superior apophyses are like those of the other vertebræ, but in the inferior, the sides are more inclined and broader, answerably to the superior apophyses of the first vertebra of the back.

488. In the six lower vertebræ of the neck, the middle holes are much larger than in the vertebræ of the back. They are in some measure triangular, being broad on the fore-side, and contracted on the backside.

§ 3. *Vertebræ of the back.*

489. The bodies of the vertebræ of the back are longer than those of the neck, and in all of them, except the first, the upper side of which is a little hollow, both upper and lower sides are equally flat.

490. From the first vertebra to the fourth or fifth, their bodies are contracted between the upper and lower sides gradually more in the lower vertebræ; and in the same manner, they grow broader between the fore and back sides: so that when viewed on the fore-side, they represent an inverted pyramid or cone, but viewed laterally, they represent a pyramid in its natural situation.

491. From the fourth vertebra to the last, the size of the bodies gradually increases, but more between the upper and lower, than between the fore and back sides. Therefore when the whole pillar of the dorsal vertebræ is viewed on the fore-side, a sensible contraction is perceivable in the upper half of the pillar, which does not appear in a lateral view.

492. The spinal apophyses are long, sharp on the upper side, and a little hollow on the lower, in which there is often a small bony line directly opposite to the sharp edge. They end in a sort of little pointed head. They are very much inclined downward, except the first three or four, which are straighter and shorter in proportion to their nearness to the vertebræ of the neck. The three last grow likewise straighter by degrees as they descend, and are broader and shorter than those above them.

493. The articular apophyses are situated almost directly above and below the transverse, and their sides are rather perpendicular than oblique. The sides of the superior apophyses

ses are a little convex and turned backward; the inferior a little concave and turned forward.

494. The transverse apophyses are pretty long, but their length diminishes by degrees all the way to the twelfth vertebra, in which they are both very short and very small. They end in a sort of head set upon a narrow neck. In the anterior part of these heads, are cartilaginous cavities answering to the tubercles in the ribs. These cavities diminish by degrees as they descend, and in the two last vertebræ there are scarce any to be seen. In the upper vertebræ they are situated more forward than in the following, in which they remove gradually outward.

495. The lateral notches are between the articular apophyses and bodies of the vertebræ, and the inferior are the most hollow.

496. Most of these vertebræ have four small cartilaginous impressions, two on each side of their bodies, one at the upper edge, the other at the lower, near the articular apophyses. These impressions are obliquely hollow, and disposed in such a manner as that the inferior in the body of one vertebra and the superior in the next below, form a sort of niche, in which the heads or ends of the ribs are articulated. In the first vertebra there is commonly an entire niche for the first rib; and half of another for the second. The two last vertebræ have generally but one entire niche on each side. These marks are peculiar to the vertebræ of the back, and easily distinguish them from the rest.

497. In the lower articular apophyses of the last vertebra, the sides are turned laterally from within outward, and are likewise a little convex; for which reason this vertebra is received both above and below; whereas the first vertebra of the neck receives both ways. Besides the seven ordinary apophyses, this last vertebra has often two small ones between the transverse and superior articular apophyses.

498. The large middle holes in the vertebræ of the back grow rounder and narrower as they descend, especially from the first to the tenth, where they begin again to be more flat and more extended, nearly in the same manner as in the two first.

499. All these large holes, each of which ought to be locked upon as a portion of a canal, have a notch in the back-side

back-side above the spinal processes, and between the articular apophyses. In most of the vertebræ of the neck, we meet likewise with large notches or flocs, above the spinal apophyses; but as they are very broad and shallow, they are but little regarded. In the last vertebra of the neck this notch is remarkable enough, and that in the last vertebra of the back appears to be deeper than any of the rest.

§ 4. *Vertebræ of the loins.*

500. The bodies of the vertebræ of the loins are the largest in the whole spine, and as they descend they increase, though much more in breadth than in thickness; that is, more between the upper and lower sides than between the back and fore sides. Between the upper and lower sides they are a little contracted in the middle, and their edges are consequently prominent.

501. The spinal apophyses are short, strait, and broad on each side, but narrow on the upper and lower parts. The upper edge is sharp; the lower divided as it were into two labia by a narrow ridge more or less prominent. The extremities swell a little, and the spinal apophysis of the fifth vertebra is shorter and narrower than the rest, and bent a little downward.

502. The transverse apophyses are longer and more slender than in the vertebræ of the back; they increase in length from the first to the third, and then diminish to the fifth. They are flat on the back part, and more even on the fore part.

503. The superior articular apophyses of all these vertebræ are hollowed lengthwise; the inferior are convex lengthwise, and placed nearer each other than the superior. The cavities are turned inward or toward each other, the convexities outward and from each other; so that they are situated in two different planes more or less parallel to the planes of the spinal apophyses.

504. This direction changes by small degrees as the vertebræ descend; and thus in the fifth vertebra the sides of the inferior apophyses are turned a little more forward.

505. Besides these seven apophyses, each vertebra has two additional ones near the superior apophyses. The lower side

of the body of the last vertebra is obliquely inclined forward, so that it is much longer before than behind.

506. The great foramina in these vertebræ are larger than in those of the back. They are flattened on the fore side, and almost angular behind, much in the same manner as in the vertebræ of the neck.

§ 5. *Os Sacrum.*

Situation in general.

507. The Os Sacrum is situated in the posterior and lower part of the trunk, as the basis by which the whole spine is supported, and from hence it has by some been termed *Os Basilare*.

Figure, and division.

508. Its figure comes near that of a long triangle with the basis upward, and the apex downward. It may be divided into the upper part of the basis; the lower part or apex; two sides, the anterior or concave, and the posterior or convex; and two lateral parts or edges. We here consider it as one bone only, as it is in an adult subject.

509. In young subjects it is made up of several distinct pieces termed *false vertebræ*, united together by cartilages, which in time diminish, grow hard, and disappear, leaving no marks behind them but little ridges or lines more or less prominent. These pieces are five in number, and sometimes six, all of them resembling the vertebræ in something. The first is much larger than any of the true vertebræ; but their size diminishes by very great degrees as they descend, so that the lowest which makes the point of the Os Sacrum, has scarcely the appearance of a vertebra.

510. In the anterior or concave side, we see commonly four pair of large holes, and sometimes more, (according to the number of false vertebræ) disposed in two longitudinal rows, and appearing to be formed by the notches in the original pieces meeting each other. Between these two rows of holes, through the whole length of the middle of this side, we observe the bodies of five or six false vertebræ cemented together, of which the uppermost or first comes nearer to the structure of a true vertebra than the rest. The last is very small, and below the holes,

it

it has a notch on each side, and sometimes a production in shape of a little horn.

511. The posterior or convex side is very uneven. The same number of holes appear here, as in the fore side, and disposed in the same order, but *Posterior side.* they are not so large. Between the two rows of holes, is a sort of spinal apophysis more or less imperfect, especially toward the upper part. In these apophyses we often find openings, sometimes in the superior, sometimes in the inferior; and thus perpendicular fissures are formed of different breadths. Sometimes a transverse opening is left between the several spines; but in all that has been here said, great varieties are observable. On the outside of each row of holes are tuberosities which appear like transverse and articular apophyses confounded together.

512. At the basis or upper part of the Os Sacrum are two true articular apophyses answering to the inferior ones of the last vertebra of the loins. Below each of these apophyses, laterally, is a large notch; and between them we see distinctly enough the upper side of the body of the first false vertebra, which is like that of the lumber vertebræ, being very much inclined backward; so that the body of this false vertebra, as well as of the last true one, is longer before than behind. From this obliquity it happens, that the Os Sacrum and last lumber vertebra form at their connection a very considerable angle.

513. Behind the body of this first vertebra of the Os Sacrum, between the articular apophyses, lies the orifice of a large canal, triangular and flat, which runs down in the middle substance of the bones between the two sides, and between the four rows of holes, behind the bodies of all the false vertebræ. It contracts as it descends, and communicates with all the large holes, being the continuation of the great canal of the spine. It is often broke into by the fissures already mentioned, on the backside.

514. The lateral parts are broad toward the top, forming on each hand a large, uneven, irregular cartilaginous surface in the figure of a great S, and *Lateral parts.* sometimes of a bird's head. By these two sides the Os Sacrum is connected with the Ossa Innominata by a cartilaginous symphysis. Between each of these lateral sides and the

nearest posterior holes, there is a large rough depression, and under that another not so large. These depressions are often pierced by several holes, which lose themselves in the inner substance of the bone.

§ 6. *Os Coccygis.*

551. The *Os Coccygis*, situated at the extremity of the *Os Sacrum*, is in some measure an appendix thereof. The figure of it is something like that of an inverted pyramid, a little bent forward toward the pelvis, or like a cuckoo's bill. The anterior side is flat, the posterior a little convex. It is made up of four or five pieces, like false vertebræ, joined together by cartilages more or less pliable. Sometimes all the pieces are entirely cemented together.

516. The first piece is the largest, and on each side of its basis there are sometimes small apophyses or cornua, joined closely to the extremity of the *Os Sacrum*. It has also sometimes a kind of transverse apophyses, with small notches on their upper part, which joining with those in the last piece of the *Os Sacrum* form a pair of holes, situated in the same row with the other large ones. The other pieces of the *Os Coccygis* are a kind of irregular squares, diminishing in size as they descend, so that the lowest is like a sesamoide bone.

§ 7. *Uses and mechanism of the spine.*

517. The spine taken together is the support of all the other bones, and the universal director of all the attitudes necessary for their different motions. To give a machine both these advantages, it must have two properties, which at first sight, appear incompatible, *viz.* strength and flexibility or pliability: and it will still be more perfect, if it be withal very light in proportion to its bulk.

518. The author of nature has framed the spine, with all these advantages, in a manner which is the more wonderful, because it is most simple. He has made the spine flexible, by the number of pieces of which it is composed: he has made it firm and strong by disposing these pieces, so as naturally to support and sustain each other, and by framing them in the most convenient manner for that infinite number of cords by
which

which they are bound together; and lastly, their internal structure renders them very light.

519. The contrivance of this excellent mechanism is not the same in all the three classes of the vertebræ. Those of the back and loins sustain each other easily enough by the extent and direction of their bodies: and in all of them this disposition is proportioned to the weight they have to bear, the inferior vertebræ being larger than those above them.

520. The contraction of this bony pillar, at the fourth or fifth vertebra of the back, does not in the least impair this mechanism: for it being at that place in a particular manner strengthened by the connection of the true ribs, large vertebræ would there have been useless; whereas, by diminishing their size, the capacity of the thorax is increased, for the more commodious reception of the viscera hereafter to be described.

521. In the vertebræ of the neck the case is different; their bodies are but of a small extent, and the sides of them narrow. The situation of the whole row of these vertebræ is oblique and inclined forward, except the two first, which are placed perpendicularly; so that this portion of the bony pillar is concave, the upper half of it being bent forward.

522. To be able to judge how far this obliquity extends in a living body; we need only either stand or sit, holding our head in a straight posture, that is, turned neither to one side nor the other, and then observe the situation of the mastoid apophyses; because the articulation of the first vertebra of the neck with the condyles of the Os Occipitis, is exactly between the anterior edges of these apophyses.

523. When a man stands or sits in an erect posture, the oblique disposition of these vertebræ puts the oblique sides of their articular apophyses almost in an horizontal situation; so that they support each other, not only by their bodies, as in the other vertebræ, but also by their articular apophyses, the bodies being thus eased of part of their burden.

524. The obliquity of these apophyses appears particularly to facilitate the rotation of the neck, or that motion by which it is turned round, as upon an axis; for the natural oblique situation of the neck would have made that motion very difficult without the obliquity of the apophyses already mentioned. The disposition of the second and third vertebra being
more

more vertical than oblique, the lateral inflections of the neck are thereby made more easy.

525. The holes in the transverse apophyses of the vertebræ of the neck, form a sort of canal for the passage of the blood-vessels. The length of this apophysis in the first vertebra enables it to turn more easily on the axis of the second; and the shortness of these apophyses in the other vertebræ, prevents them from injuring the neighbouring parts in the lateral inflections of the neck.

526. The length of the spinal apophysis of the second vertebra facilitates the rotation of the first. The smallness of this apophysis in the three following vertebræ, prevents them from compressing the neighbouring parts, when the neck is bent backwards; and they are broad and forked, to afford sufficient room for the insertion of muscles.

527. The vertebræ of the back serve principally for the formation of the cavity of the thorax, by sustaining the arches of the ribs; and this cavity is augmented by this, that the whole row of these vertebræ is concave on the fore-side.

528. The length of their spinal apophyses is proportioned to the great number of muscles inserted in them. The oblique situation of these apophyses, and their lying for the most part close on one another, not only prevents the inconveniences of so great a length; but hinders the vertebræ from being bent backward, and consequently enables them to support great weights without sinking under them.

529. The curvature of the transverse apophyses backward, enlarges the capacity of the thorax, and gives to the double articulation of the ribs a peculiar sort of obliquity, without which it is impossible to conceive how, by simply raising the ribs, all the dimensions of the thorax should be increased, and diminished by lowering them.

530. The articular apophyses of the back being almost vertical, and nearly in the same plane, small degrees of flexion and extension are thereby made practicable, as also lateral inflections; but they cannot allow of any rotation. As these apophyses are placed between the transverse, and near the posterior extremities of the ribs; they are very little exposed to strains or external injuries, and thereby their small size, when compared with the bodies of the dorsal vertebræ, becomes sufficient.

531. The gentle curvature of the row of lumber vertebræ counterbalances the different directions of the other portions of the spine. The shortness and straitness of their spinal apophyses gives room to bend the whole spine backward on the loins; and their largeness affords sufficient place for the insertion of muscles. The length of their transverse apophyses, facilitates the action of the muscles; but the shortness of the upper and lower apophyses, prevents their striking against the ribs, or *Ossa Innominata*, in lateral inflections.

532. The size of the articular apophyses is proportioned to the great efforts which they often suffer in their motions. The particular direction of these apophyses sets bounds to the motions of rotation, by their meeting and striking against each other; and it is principally on this occasion that their large size becomes necessary, to enable them to sustain such strokes without breaking.

533. The use of the *Os Sacrum* is to sustain the spine with all that belongs to it; but in order to this, it was necessary that it should be strongly connected with, and inclosed by the *Ossa Innominata*, with which it likewise serves to form the pelvis; the posterior part thereof belonging to this bone. Its lower extremity is turned very far backward, and thereby the lower part of the pelvis is enlarged. Its appendix, the *Os Coccygis*, serves chiefly to support the *intestinum rectum* and anus, as shall be said in another place.

534. Lastly, the whole canal of the spine, from the first vertebra of the neck, to the extremity of the *Os Sacrum*, may be looked upon as an articulated elongation of the cranium, serving to contain a production of the brain called the *spinal marrow*. This canal is larger in the neck and loins than in the back. The lateral holes formed by the notches in each vertebra transmit the same number of nerves.

§ 8. *The bones of the thorax; and first, the ribs.*

535. The thorax called commonly the *breast*, is the first and superior proper part of the trunk. It may be compared to a sort of cradle, being composed of several lateral pieces, termed *ribs*, and of one anterior piece, called *sternum*, which, with the twelve vertebræ of the back, form the bony cavity of the breast.

Figure and general situation of the ribs.

536. The ribs are bony arches of different sizes, situated transversely and obliquely on each side of the thorax, and so disposed, as that their extremities are turned toward each other.

537. They are commonly twenty-four in number, twelve on each side. This number varies sometimes on one side only, sometimes in both. They are distinguished into true and false.

538. The seven upper ribs on each side go to the sternum and thus form entire arches; for which reason they are named *true ribs*. The five inferior ribs do not reach the sternum, and because they do not form entire arches, they are termed *false ribs*.

539. In each rib we may consider in general, the middle part or body; two extremities, one anterior the other posterior; two sides, one external and convex, the other internal and concave; two edges, one superior, the other inferior; and two labia in each edge, one external, the other internal. The posterior extremity, which may be called *the head of the rib*, is articulated with the vertebræ of the back. At the anterior extremity, fresh ribs are lengthened out by cartilaginous epiphyses, stuck into their bony ends. This production is termed the *cartilage* or *cartilaginous portion of the rib*.

540. Each of the true ribs, at the posterior extremity, hath two small cartilaginous impressions, distinguished by a kind of angle, by which they are articulated with the lateral cartilaginous impressions in the bodies of two vertebræ of the back: but the first rib has no more than one such impression, being articulated with one vertebræ only.

541. At a small distance from the head of this extremity, posteriorly, is another cartilaginous impression on each side, a little convex and closely joined to a small tuberosity. By these the ribs are articulated with the cartilaginous depressions in the transverse apophyses of the dorsal vertebræ; and the tuberosities serve for the insertion of ligaments. The portion which lies between the head and these impressions, is contracted, and represents a neck.

542. When the posterior extremity of a rib is articulated with

with two vertebræ, the second articulation is always with the transverse process of the lowest of the two.

543. Between the tuberosity and middle part of the ribs, there is on the outside of most of them, a kind of oblique rough angle of different breadths. In the first rib this angle is not distinct from the tuberosity. In the second, it reaches but to a small distance from it. In the third rib, this distance is greater, and from thence continues to increase gradually all the way to the third false rib; so that if we look directly at the back of a skeleton, these angles seem to represent the two legs of a pair of compasses opened pretty wide.

544. On the inside of the ribs towards the lower edge, we observe a groove reaching from the angle, all the way to the extremity, and that chiefly in the five lower true ribs, and the first three false ones. The upper edge of the two first ribs is sharp; the lower a little rounded. The upper edge of the third is more obtuse, and the lower more flat. In the rest, the upper edge is something rounded, and the lower more or less sharp.

545. These ribs increase in length as they descend, and their anterior extremities on each side are at a greater distance from one another; so that all the extremities of one side, with the extremities of the other, represent on the forepart of the breast, an angle almost like that which I already took notice of on the backpart. The extremities of the first ribs on each side do not lie in the same line with the rest, but, being much shorter, are situated further back. The same thing is sometimes, though very rarely, observable in the two second ribs. There is this likewise peculiar to the first rib, that its breadth increases from behind, forward.

546. In all the ribs the anterior extremity is lower than the posterior. The first is but little inclined, the second more, and the inclination of all the rest increases as they descend; their anterior extremities being proportionably at a greater distance from each other than the posterior, the spaces between which are every where nearly the same.

547. The ribs are much more crooked in the back than in the forepart. The curvature of the two first ribs on each side, lies almost in the same plane with the two extremities of each. This equality begins to be lost in the third rib, which

is something contorted from the angle all the way to the anterior extremity, the lower edge being turned a little outward, and the curvature being turned a little upward, about the middle of the arch, and afterwards a little more downward, from thence to the anterior extremity. This contortion increases in the following ribs, all the way to the third false rib; all which look like a contorted Italic *f*, and when laid on an even table, one extremity is always turned upward, the other downward.

548. The appendices, epiphyses, or cartilaginous portions of the true ribs increase in length, as they descend, in the same manner as the ribs themselves. Each of them, except the first, terminates by two little cartilaginous sides joined together by an angle, by which they are articulated with the sternum. The extremity of the first cartilage is very broad, and cemented to the sternum by a symphysis, like that by which the other end is connected with the bony extremity of the rib.

549. The cartilages of the first three or four ribs lie nearly in the same direction with the ribs themselves. In the ribs below these the cartilages make angles, at which they turn upward toward the sternum, and this curvature increases in proportion as the ribs descend. The lowest cartilages, in changing their direction upwards, lie very close to each other, and those of the last two true ribs have often at their inferior edge a sort of apophyses or production, by which they are connected with the cartilages immediately below them.

550. The last two true ribs extend considerably in breadth towards their lower sharp edges, from the angle for a good distance anteriorly. Afterwards they contract in breadth and increase in thickness, forming a sort of neck a little longer than that at their posterior extremity; then their breadth begins to increase again by degrees all the way to the anterior extremity. In all the ribs, this extremity terminates in a cavity in which the cartilages are grafted.

551. The three uppermost false ribs increase in breadth from the angle forward, in the same manner as already said. The grooves are in them most considerable. They have heads, necks, tuberosities, and angles, almost the same as in the last true ribs. Their length diminishes by degrees and their anterior extremities separating from each other in the same

same manner with those of the true ribs, lie in the same line with them. The last two have only one impression at their posterior extremities, and are without any tuberosity. They are both much shorter than the rest, especially the fifth.

552. All the false ribs have cartilaginous appendices. The first is longest, and fixed to the cartilage of the last true rib. The two following are united together at their extremities. The last two are connected only to muscles and ligaments. They are both very short, especially the last, which is not above a quarter of an inch in length. All these cartilages of the false ribs are pointed at their extremities.

553. The ribs are articulated anteriorly with the sternum, and behind with the vertebræ of the back. The first rib is entirely united with the sternum, by *Connection.* means of its cartilage. In the six following, the extremities of the cartilages join that bone.

554. The three upper false ribs are joined to each other by the extremities of their cartilages; and the first is likewise joined to that of the last true rib. The two last have no such connection, as has been already said.

455. The connection of the ribs with the vertebræ of the back is for the most part by a ginglymus. The first rib on each side is articulated by its head, with the lateral impression in the body of the first vertebra, and by its tuberosity, with the small cavity in the transverse apophysis of the same vertebra.

556. The head of the second rib is articulated by its head with the impressions in the lower part of the body of the first vertebra, and in the upper part of the body of the second; and by its tuberosity, with the articular cavity in the transverse apophysis of the second vertebra.

557. All the other ribs, except the two last of the false ribs, are articulated in the same manner; that is, by their heads, with the impressions on the bodies of two vertebræ next each other, and by their tuberosities, with the transverse apophysis of the lowest of each two vertebræ. The eleventh and twelfth ribs are commonly articulated by their heads only, with the impression in the body of one vertebra.

558. From what has been said, it is evident, that the ten upper ribs are confined to two motions, one upward, the o-

ther downward ; whereas the two last are left more at liberty, and are therefore termed *floating ribs*.

559. The ribs joined to the vertebræ of the back and sternum form a cavity, capable of expansion and contraction, in which are contained chiefly the organs of respiration, and those of the circulation of the blood. The mechanism of their structure shall be spoken to hereafter.

§ 9. *The Sternum.*

Situation in general.

560. The sternum is situated lengthwise in the anterior part of the thorax.

Figure.

561. It is a long flat bone, not all of the same breadth, representing a sort of dagger.

Division.

562. It is generally made up of three principal pieces, the first broad and short ; the second longer and narrower ; the third a sort of small appendix, called by the Greeks *Xiphoides*, from its resemblance to the breast of a broad sword.

563. The first or uppermost piece is broad and thick at the top, but thinner and narrower below, being nearly of the figure of a triangle with the three angles cut off, or of an irregular square. We distinguish in it two sides, one external or anterior, the other internal or posterior ; four edges, one superior, two lateral, and one inferior ; and four imperfect angles, two superior, and two inferior.

564. The anterior or outside is unequally convex, the posterior or inner side a little concave.

565. The upper edge is the thickest, with a large smooth notch or slope in the middle, called by the ancients *the furca*. The two superior angles are two large thick articular notches, situated obliquely on each side of the furca. The lateral edges are thin and oblique, and in each of them we see an oblong cartilaginous mark, which belongs to the cartilage of the first true rib. The two inferior angles are two articular half-notches, which receive the cartilage of the second rib. The lower edge is smaller and thicker than the others, being joined by symphysis to the second piece.

566. The second piece of the sternum is much longer than

than the first. It is flat on both sides, and broader towards the lower than towards the upper part. We observe in it sometimes, especially on the fore-side, several transverse lines, which point out the places where the pieces of which it is made up in children are united together. Both sides ~~are~~ are flat, but depressed more or less through the middle of their whole length. The upper edge is small, being proportioned to the lower edge of the first piece with which it is connected by a cartilaginous symphysis. The lower edge is still smaller, appearing like a truncated angle. *The second piece.*

567. The two lateral or greatest edges have each a cartilaginous half-notch, and five cartilaginous entire notches. The half-notches are at the upper part of the lateral edges, where they meet the half-notches in the first piece. The five entire notches come nearer to each other in proportion as they are lower, and part of the last belongs often to the third piece.

568. The third piece, called commonly *cartilago xiphoides*, or *ensiformis*, and in French by a word which signifies the brisket, is entirely cartilaginous in young subjects; but in an advanced age it generally ossifies either wholly or in part; in some subjects later than in others; it would therefore be more properly named *appendix xiphoides* or *ensiformis*. *The third piece.*

569. This piece is joined to the lower extremity of the second, between the cartilages of the last true ribs; and it is often more or less notched on each side, to form part of the last articular notches of the sternum. Its figure is nearly that of the point of a broad sword, from whence it has its name both in Greek and Latin; but neither its figure nor size are constant. In some subjects it is forked, in some perforated. Sometimes it is very large, sometimes very small, hardly exceeding the third part of an inch.

570. The inner substance of the sternum is almost all cellulous and very slender, and covered on the outside with a thin compact lamina. *Substance.*

571. The sternum completes the fore-part of the cavity of the thorax, and sustains the anterior extremities of the ribs, being sufficiently fixed to resist compressions, and other outward accidents; and yet moveable enough by means of its articulation with the cartilages of the ribs, not to obstruct the motions necessary for respiration. *Uses.*

It

It likewise serves for the insertion of several muscles, and to support the mediastinum, &c.

§ 10. *The bones of the Pelvis; and first, the Os Ilium.*

Situation of the pelvis in general.

572. The pelvis is the third and lowest part of the trunk, consisting chiefly of two large pieces, called *Os Innominata*, which being united anteriorly by a cartilaginous symphysis, and posteriorly to the two sides of the *Os Sacrum*, represent a kind of basin. When considered separately, they have no regular figure, being of different breadths in different parts, unequally convex on the outside, and unequally concave on the inside.

573. Each bone is but one piece in adult subjects, but in children it consists of three pieces, joined together by a cartilage, which afterwards perfectly ossifies, leaving commonly no vestige of the first division. Anatomists, however, consider in it, even in adults, three different portions, and distinguish them by different names, as if they were three distinct bones.

574. Of these three portions, the largest is superior and posterior, called *Os Ilium*; the second, inferior, called *Os Ischium*; and the third and smallest, anterior, called *Os Pubis*.

575. Before we treat of each of these portions separately, it must be observed, that in the entire bone, there are several common parts, or which belong to more portions than one, viz. a deep cartilaginous cotyloide cavity, called in Latin *Acetabulum*; formed by all the three portions: a large opening, called *foramen ovale*, formed by the *Os Ischium* and *Os Pubis*: a large posterior notch or sinus, called the *ischiatric notch*, formed by the *Os Ilium* and *Os Ischium*: an oblique eminence or protuberance above the acetabulum towards the foramen ovale, made by the *Os Ilium* and *Os Pubis*. To these may be added a ridge on the inside of the pelvis, which divides the upper wide part from the bottom, to which alone the ancients gave the name of *pelvis*.

576. The *Os Ilium* was so named by the ancients, because it supports the parts called by them *Ilia*.

Size and figure of the Os Ilium.

577. This bone is the largest of the three. It is flat, very broad, unequally convex and concave, partly round and partly of an irregular square figure.

578. It is divided commodiously enough into the crista, basis, anterior and posterior edge, and two sides, one external, the other internal. *Division.*

579. The crista is the upper part, being a pretty thick arched border, the circumference of which is a little more than a quadrant of a circle. The anterior and middle part is convex outward, the posterior part a little convex inward. We distinguish in it two labia, and a middle space or interstice between them. It is originally an epiphysis, of which we sometimes see plain marks in a very advanced age.

580. The posterior portion of the crista, which is convex inward, is much thicker than the anterior, and for that reason might be called the *tuberculum of the crista*. The whole crista appears to be crufted over with a cartilage, which in reality is no more than the dried tendinous insertions of the muscles.

581. The anterior edge of the Os Ilium has two eminences or tubercles, called *the anterior spines*; one superior, the other inferior; and likewise two notches, one between the spines, the other below the inferior spine.

582. The posterior edge is shorter and thicker than the anterior. It terminates likewise in two eminences or spines, between which there is a considerable notch.

583. The basis or inferior part of this bone is the thickest and narrowest of all. It forms anteriorly a portion of the acetabulum, and posteriorly, almost all the ischiatic sinus.

584. The outside is convex on the fore-part, and concave on the back-part. We observe on it the remains of a long semicircular line which reaches from the upper anterior spine, to the great ischiatic sinus, being a muscular mark. Above and behind this semicircle there are several other impressions and muscular marks. A little above the edge of the acetabulum we see likewise many inequalities which surround part of that edge in a semicircular form, being a collection of muscular and ligamentary marks.

585. The inside is unequally concave, and has several inequalities toward the back-part, the chief of which is, that large cartilaginous surface of the figure of an S, or of a bird's head, which answers to the lateral surface of the Os Sacrum, with which it is connected by a cartilaginous symphysis. The other inequalities are much of the same kind with

with those in the lateral part of the Os Sacrum, with which they form several rough and irregular cavities. From the upper part of the cartilaginous surface or symphysis, all the way to the oblique eminence, runs a prominent line which bounds the concavity of the inside of this bone, and distinguishes the margin of the pelvis from the bottom.

§ 11. *Ossa Ischium.*

Situation in general and division.

586. The Os Ischium is the lowest portion of the Os Innominatum, as well as of the whole trunk. It is divided into the body tuberosity, and ramus or branch.

587. The body of the Os Ischium forms the lowest and greatest part of the acetabulum, and sends out an apophysis backward, called *the spine of the ischium*.

588. The tuberosity is very thick, unequal, and turned downward; and it is on this part that the whole body rests, when we sit. It appears cartilaginous, because of the dried and hardened remains of the tendons. The whole convex portion of it is originally an epiphysis, of which the marks are obliterated sooner in some subjects than in others. Three muscular impressions may be distinguished in it.

589. The branch of the ischium is a kind of small, flat, thin production or apophysis, which ascends forward from the curvature of the tuberosity to the Os Pubis; and it is often covered in part by a continuation of the epiphyses of the tuberosity.

590. These three parts of the ischium taken together form a large opening, which makes the greatest part of the foramen ovale. Three other notches are remarkable upon this bone: one posterior between the tuberosity and the spine, for the passage of the internal obturator muscle, which is a little cartilaginous, and divided into three or four small superficial channels; one lateral between the tuberosity and the acetabulum, for the passage of the external obturator muscle: and one anterior at the edge of the acetabulum, for ligaments, &c.

§ 12. *Ossa*

§ 12. *Ossa Pubis, and Acetabulum.*

591. The Os Pubis is the least of the three portions of the Os Innominatum. The two together form the fore-part of the pelvis; and in each we may distinguish the body, angle, and branch. *Situation in general and division.*

592. The body of the Os Pubis is its upper part, situated transversely before the inferior part of the Os Ilium. Its posterior extremity is very thick, and by its union with the Os Ilium forms the oblique eminence which distinguishes these two portions of the Ossa Innominata. It likewise contributes to the formation of the cotyloide cavity. Its anterior extremity ends in a small eminence or tuberosity, called *the spine of the Os Pubis*, which is sometimes double.

593. The upper edge has on its inner part an oblique ridge, which may be called *the crista of the Os Pubis*, and is continuous with that ridge which distinguishes the margin and bottom of the pelvis. Before this crista is a broad oblong oblique slope. The lower edge is obliquely notched, and forms the upper part of the foramen ovale.

594. The Angle of the Os Pubis is its anterior portion, and makes part of that connection, called *the symphysis of the Ossa Pubis*. This portion is flat, and not very thick; and in some subjects, toward the upper part of the foreside, near the angular curvature, it has an eminence which increases the size and extent of the spine already mentioned. The two Ossa Pubis, connected together by this portion, form on the foreside an unequal convexity, but on the backside a pretty even concavity.

595. The branch of the Os Pubis is a flat thin apophysis, which, running downward, unites with the branch of the ischium by a cartilaginous symphysis, of which only some marks remain in adults. It completes the formation of the foramen ovale. The branches of the two Ossa Pubis form on the foreside a pointed arch, which in the natural state is much more round.

596. Besides what has been said of the acetabulum in general, there are other particulars observable about it, which could not well be mentioned till after the description of the three portions of which it is *Acetabulum.*

made up. These are the edge called *supercilium*, the cartilaginous cavity, the impression at the bottom of the cavity, and the notch in the edge.

597. The edge or *supercilium* is very prominent on the upper part; on the sides this prominence decreases as they descend, and between the anterior and inferior part it is quite lost. In the natural state it is increased by an additional elastic circle, which shall be described in the treatise of fresh bones.

598. The cavity is proportionable to the prominence of the edge, and consequently deeper on the upper and back part than on the lower and fore part. It is covered with a very smooth cartilage, except from the middle to the notch.

599. This portion of the cavity which is without cartilage, is what I called *the unequal impression*, which is broader toward the bottom of the cavity than toward the edge, and serves to contain a ligament and a bundle of glands.

600. The notch is precisely between the anterior and inferior portion of the edge of the cavity, near the foramen ovale, which it in a manner unites with the cavity. The situation of this notch is oblique with respect to the direction of the whole body in an erect posture.

601. The substance of all the three portions *Substance of the Os Innominatum.* is mostly spongy, except in the middle of the Os Ilium, where the two tables uniting, render the bone transparent; and the same is to be said of the acetabulum.

602. The *Ossa Innominata* are joined to the Os Sacrum, and to each other by a cartilaginous symphysis. *Connection.* They are articulated with the Os Femoris by *enarthrosis*, as we shall see in describing that bone.

603. The *Ossa Innominata*, together with the Os Sacrum, *Uses.* form the pelvis, which is part of the cavity of the abdomen, and supports several viscera, especially those which are the common-sewers of the urine and gross excrements, and those by which the two sexes are distinguished. The pelvis is larger in women than in men; the *Ossa Ilium* and *Ischium* are wider. The arch formed by the branches of the *Ossa Pubis* is likewise greatest in females.

604. Moreover, these bones, together with the Os Sacrum, support the whole trunk and all the parts belonging to it, and

and also the lower extremities. In a word, they are the basis of the whole body of man, and the general centre of all its motions, when standing, sitting, or lying.

A R T. IV.

The bones of the upper extremities. ~~to be seen in the next plate~~

605. **T**HE upper extremities of the human body are two in number; fixed to the upper and lateral parts of the trunk, from whence they may be extended below the inferior part thereof, that is, below the pelvis. Each of them is divided into four parts, the shoulder, the arm, the forearm, and the hand.

§ 1. *The bones of the shoulder; and first, the Scapula.*

606. The shoulder is made up of two bones, one large and posterior, called *the scapula*; the other small and anterior, named *the clavicle*.

607. The scapula is a large bone, in some measure of a triangular figure, situated laterally at the upper and posterior part of the thorax, from about the first rib down to the seventh.

Situation in general and figure of the Scapula.

608. It may be divided into two sides, one external or posterior and convex, the other internal or anterior and concave; three edges, one named *the basis*, and two named *costæ*, one superior, the other inferior; three angles, one anterior, called *the head or neck*, one superior, and one inferior. I shall begin with the edges, and end with the sides.

Division.

609. The basis is the longest edge of the scapula. It is commonly situated on one side of the spine, a little obliquely, the upper part of it being nearer the vertebræ than the lower. It is, as it were, divided into two parts by a very obtuse angle, which distinguishes the superior quarter from the three other quarters. It is considerably thick, and is accordingly divided into two labia, one exterior, the other interior. It continues to be an epiphytes in many adult subjects,

jects, towards both its extremities, especially towards the lower.

610. The superior costa is the shortest and thinnest of the three edges. It is situated almost transversely between the superior point of the basis and neck of the scapula, being a little more raised toward the basis than at the other end, where it often terminates by a small notch. It is divided into an external and internal labium.

611. The inferior costa is of a middle length between the other two edges. Its situation is very oblique between the inferior point of the basis and neck of the scapula. It is thicker than the rest, and often appears to be double, having two very distinct labia, the uttermost of which is thin, the other round. These two labia are separated by a kind of channel, or groove; and upon the external labium is a narrow impression, which runs from the neck through two thirds of the length of the costa.

612. The neck of the scapula is the biggest of the three angles. It ought more justly to be called a *head* with a very short neck; and a superficial or glenoide cavity in the top of it, which is lined with a cartilage and of an oval figure, but pointed at the upper part, and rounded at the lower; and deeper in the natural state than in the skeleton, as will be seen in the history of fresh bones. In the natural situation of the scapula this cavity is turned obliquely forward, and not directly outward. Between the edge of this cavity and the contracted part which is the true neck, some inequalities are observable, which are the remains of the symphysis of ossification.

613. At the upper part of the neck there is a production or epiphysis resembling a crooked finger or crow's bill, called the *coracoid apophysis* or *epiphysis*, which at its origin has a tuberosity, for the insertion of the ligaments of the clavicle. It terminates by three muscular impressions, which all together form an obtuse point.

614. The angles next the basis have nothing very remarkable, only that the superior is more acute than the inferior in some subjects.

615. The outside of this bone is unequally convex, and, a little below the superior costa, shows a long, high, thin eminence, called the *spine of the scapula*, which rises gradually higher

higher from the curvature or obtuse angle at the basis all the way to the neck, and afterwards turns upwards and forward over the coracoide apophysis, forming another broad apophysis called the *acromium*. The name of *crista* is given to the edge of this spine.

616. This crista is extended in breadth in three particular places. The first is near the basis of the scapula, where there is a smooth triangular surface. The second is a kind of oblong, flat, and rough tuberosity. The third is at the acromium, of which already. On the anterior edge of this apophysis, near its point, is a small cartilaginous apophysis for the articulation of the scapula with the clavicle.

617. The body of the spine divides the outside of the scapula in two portions, the uppermost and least of which is termed *fossa supra-spinalis*, the lowest and largest, *fossa sub-spinalis*, in which we observe a long depression, lying a little above the costa inferior, and running from the inferior angle to the neck. Near this inferior angle we see likewise a kind of small distinct surface unequally triangular and oblong, which runs up upon the inferior costa towards the channel or groove in its external labium.

618. The inside of the scapula is irregularly concave, chiefly toward the upper part, and, in a manner, divided into several superficial and longitudinal fossulae, by little ridges which run like radii from the neck toward the basis. The direction of these lines is transverse with respect to that of the ribs.

619. Besides these parts, we observe likewise three notches, one very large, between the neck and the spine; one small, between the superior costa and the coracoide apophysis; and one of a middle size, between that apophysis and the glenoide cavity. There is sometimes a particular hole which either perforates the basis of the spine at its middle, or is there lost in the substance of the bone.

620. We must not forget here, two small rough marks or impressions immediately above and below the glenoide cavity; the lowest of which extends itself a little over the neighbouring costa. They might be termed muscular impressions of the neck of the scapula.

621. In the neck, spine, basis, inferior costa, and coracoide process, there is a diploe, the rest

Substance.

of

of the bone is transparent, thin, and almost without any middle cellulous substance.

622. The scapula is articulated with the clavicle, by the acromium, and with the Os Humeri, by the glenoid cavity. It is likewise joined to the trunk by a fleshy symphysis or syssarcosis. It serves to facilitate the motions of the arm, to give insertion to a great many muscles, and as a shield, to defend the back-parts of the thorax.

*Connection
and uses.*

§ 2. Clavicula.

623. The two clavicles are situated transversely and a little obliquely, opposite to each other, at the superior and anterior part of the thorax, between the scapula and the sternum.

*Situation in
general.*

624. Each clavicle resembles in some measure an *Italic s*, being a long bone, irregularly cylindrical, bent forwards near the sternum, and backward near the scapula, as if it were made up of two arches joined endwise in opposite directions, that which lies on the fore-part of the breast being the largest. The clavicles are straighter in women than in men.

Figure.

625. The clavicle is divided into a body or middle part, and two extremities, one anterior, inferior, and internal, which I term the pectoral or sternal extremity; the other posterior, superior, and external, which I name the humeral or scapular extremity.

Division.

626. The pectoral extremity is the thickest, and of a triangular figure, especially near the end, where it is a little enlarged, and shows a cartilaginous surface with three angles, of which the lowest is the most prominent, and turned a little toward the cavity of the thorax. Near these angles there are several muscular and ligamentary impressions, one of which near the inferior angle is sometimes raised like a tubercle.

627. The humeral extremity is flat and broad, and two sides may be considered in it, one superior, the other inferior; likewise two edges, one anterior, the other posterior; and a small articular surface.

628. The upper side has several inequalities, and in the lower there is a kind of oblong rough oblique tuberosity. The posterior

posterior edge is convex, thick, and uneven, being that of the small arch of the clavicle. The anterior edge is concave, narrow, and smooth every where, except near the great arch where it has a rough impression. The articular surface terminates this extremity, being cartilaginous, turned obliquely forward, and of an oval figure, like that of the acromium, with which it is articulated.

629. The body or middle portion, which, together with the pectoral extremity, forms the great curvature of the clavicle, is not so thick as the extremities. It is a little flattened, both on the upper and lower sides, and therefore two edges may likewise be distinguished in it. The upper side is pretty even, the lower something rougher, and a little depressed by a superficial channel. The edges are rounded, the anterior being convex, the posterior concave.

630. The inner substance of the extremities is *cellulous*. The rest is more solid, consisting of very thick sides, with a narrow cavity more or less filled with reticular bony filaments. *Substance.*

631. The particular situation of this bone is easily understood from what has been said. The most uneven side of the body, and rough side of the humeral extremity, are always to be turned downward. *Situation in particular.*

632. The clavicle is articulated with the acromium and sternum by arthrodia. The articulation with the scapula, by means of the acromium, is as real and distinct as the articulation with the sternum; which last appears something extraordinary in the skeleton, where the small notch in the sternum is nowise proportioned to the broad extremity of the clavicle. In the description of the fresh bones, I shall show how this is to be accounted for; and likewise demonstrate the ligamentary connections. *Connection.*

633. The clavicles serve for buttresses to the scapulæ, and bound their motions forward and upward; by their ligamentary connections they likewise hinder the scapulæ from running too far back; which might happen in those who drag burdens behind them, &c. They also give insertion to many muscles. *Uses.*

§ 3. *Os Humeri.*

634. The *Os Humeri* or bone of the arm is both longer and thicker than any other bone of the upper extremity. It is situated under the acromium, along the lateral part of the thorax, from which however it may be removed to a considerable distance, in all directions. Its figure is irregularly cylindrical, and it is thick at one end, and broad at the other.

Division. 635. It is divided into the body, and two extremities, or into an upper, middle, and lower part.

636. The upper part is generally called the *head of the Os Humeri*, and the part immediately below that, is called the *neck*.

637. In the head we consider a half-globe obliquely inclined, crufted over with a smooth cartilage: two tuberosities, one large, terminating upwards in a point, over-against the half-globe; the other small, placed laterally between the large one and the half-globe; a channel or groove between the two tuberosities; four muscular impressions, three of which are on the large tuberosity, one in the apex, one on the side opposite to the groove, and the third lower down on the same side over-against the small tuberosity upon which the fourth is found. Of these four impressions, that on the small tuberosity, and the second of the other three, are the largest. All these parts of the head of the *Os Humeri* are one epiphysis in children, of which very plain marks remain sometimes in an advanced age.

638. The channel or groove between the two tuberosities is continued downwards in an oblique direction through one quarter of the length of the bone, and there becoming rough, it forms a muscular impression not always equally sensible. The edges of this channel are two ridges or prominent lines continued down, as it were, from the two tuberosities. That from the great tuberosity is the most considerable, and is continued down to the middle of the bone, where it is lost in a long, broad, raised muscular impression more or less rough. The other which comes from the small tuberosity, is less prominent and shorter. At the side of this ridge, toward the lower part, are two other narrow longitudinal and superficial

superficial muscular marks one above the other, the lower extremity of the first reaching down on the foreside of the upper extremity of the second.

639. The middle part or body of the *Os Humeri* comes nearer to a cylindrical figure than the extremities. It is a little raised at the rough eminence or impression already mentioned. On each side of this eminence is another muscular impression, which uniting immediately below it, it appears to be inclosed between them as between the two prongs of a fork. On that side which answers to the middle of the half-globe, we see likewise a longitudinal muscular mark, and about the middle of that side which is even with the great tuberosity, there is an oblique hollow turning of a considerable length and breadth, which running down by the side of the forked impression, makes this part of the bone appear contorted.

640. The lower extremity of the *Os Humeri* is triangular from its very beginning, and from thence grows very broad and flat, being bent a little near the end, towards that side which answers to the small tuberosity in the upper extremity. It is divided into three sides, two anterior, and one posterior, which is the broadest; and into three angles, one anterior, and two lateral.

641. At the end of this broad extremity are two tuberosities, one short and prominent, answering directly to the middle of the half-globe, the other oblong, rough, and resembling a crista, which answers to the apex of the great tuberosity of the head. The short tuberosity is called the internal condyle, the other the external condyle.

642. Between these two condyles, on the very lowest part of the concave side of this extremity, are two articular eminences, one double like a pulley, next the short condyle; the other rounded like a small head, next the long condyle. The pulley has a great and small edge with a depression between them. The small edge is lost in the round eminence or head, the great one is gradually widened, and ends in a sharp circumference. This pulley is situated obliquely; for on the concave side it approaches toward the short condyle, and on the other, it is turned from it.

643. Three fossulæ are likewise observable in this lower part of the bone, two anterior, one immediately above the

Pulley, the other above the small head; and one posterior, which is very large, and situated likewise immediately above the pulley. In children, the pulley, the small head, and the short condyle are epiphyses.

644. The outer substance of this bone is compact, especially in the middle part, within which there is
Substance. a large tubular cavity, containing a reticular texture of bony filaments. The outsides of the extremities are less solid, and their inner substance is cellulous.

645. The particular situation of this bone deserves well to be considered, because we are often misled in
Situation in particular. forming an idea of it, by viewing the bone itself separated from the trunk of the body, by the figures which have been given of it, and by the undue application of the terms *external*, *internal*, *anterior*, and *posterior*, to the different parts thereof; which mistakes may be of very bad consequence in many surgical cases.

646. When we examine the Os Humeri, as lying along either side of the trunk, in its natural situation; the head will be found so disposed as that the half-globe is turned inward and backward, answering to the situation of the glenoid cavity of the scapula; the great tuberosity outward and forward; the channel between the two tuberosities, almost directly forward; the long condyle, said commonly to be external, turned as much forward as outward; and the short condyle called the *internal*, turned as much backward as inward.

647. This bone is articulated above with the glenoid cavity of the scapula, by enarthrodia, which is
Connection. much plainer in the fresh bones than in the skeleton; and below, with the two bones of the fore-arm, in the manner hereafter to be described.

648. The uses of this bone are generally well enough known. The explication of all its different motions presupposes the knowledge of the fresh bones, and of their ligaments and muscles; and therefore must be referred to another place.

§ 4. *The bones of the fore-arm; and first, the Ulna.*

649. The fore-arm is made up of two long bones, whereof one is named *cubitus* or *ulna*, the other *radius*.

650. The ulna is irregularly triangular, diminishing in thickness from one end to the other. It may be divided into the body or middle part, and two extremities, one great, the other small. *Figure and division of the ulna.*

651. In the great extremity we observe two eminences, one large, called *olecranon* or *ancon*, the other small, called *corone* or the *coronoide apophysis*; and two semilunar or sigmoide cavities, one great, the other small.

652. The olecranon is a large apophysis ending in a rough tuberosity and an obtuse point. The tuberosity makes the corner of the elbow; the point is lodged in the posterior cavity of the lower extremity of the *Os Humeri*, when the fore-arm is extended. Next under the tuberosity is a flattish oblong, triangular surface, on the outside of which is another of the same kind, but longer and a little hollow, together with a muscular fossula.

653. The coronoide apophysis is prominent and a little pointed, resembling a broad short beak. It is received into the anterior cavity above the pulley, at the lower extremity of the *Os Humeri*, when the fore-arm is bent.

654. The great sigmoide cavity lies directly between these two eminences, reaching from the point of one to the point of the other. It is articular, covered with a smooth cartilage, and divided through its whole length by a middle angular line; being thus suited exactly to the pulley of the *Os Humeri* upon which it moves obliquely; these two together making a most perfect ginglymus, as well in respect of their structure as of their use. The half-cavities on each side the angular line are also divided transversely by another line a little hollow, which terminates at the middle of each edge of the cavity, by a very small notch.

655. The small sigmoide cavity, which may likewise be termed transverse or lateral, is a sort of transverse notch in the inferior portion of one edge of the great sigmoide cavity, at the side of the coronoide point, directly opposite to the muscular fossula already mentioned. It is covered with

a cartilage as well as the great one, of which it appears to be a true continuation; and it belongs to the articulation of the radius. Near this cavity, directly under the coronoide apophysis, there is a very rough muscular impression, sometimes raised like a tuberosity.

656. This upper extremity is oblique, and its obliquity answers to that of the pulley in the Os Humeri.

657. The small extremity is cylindrical, of a less diameter than any other part of the bone. It may be reckoned a kind of neck ending in an inverted head, flat at top, and of a cylindrical circumference, both which are covered with the same smooth cartilage, and the circumference is broader on the side of the coronoide apophysis, and small sigmoide cavity, than any where else. From the head runs down a short styloide apophysis, on the side of the tuberosity of the olecranon, distinguished from the rest of the circumference by a small notch.

658. The middle portion or body of the ulna is divided into three sides, and three angles. One of the sides is narrow and rounded, one broad and hollow, and the third flat, and marked with an oblique line on its upper part. The narrow side answers to the tuberosity of the olecranon, and is covered only by the common integuments. The other two sides are distinguished from the former by two blunt angles; and they unite at a sharp angle which lies opposite to the rounded side, and answers to the point of the coronoide apophysis. The hollow side is even with the small sigmoide cavity, and the flat side opposite to it. These two sides give insertion to many muscles, and the sharp angle, to what is called the *interosseous ligament*. At the top of this angle there is a narrow oblong muscular impression. The angle common to the rounded and flat sides, ends below in an oblong uneven muscular eminence.

659. The substance of the ulna is much the same with that of the Os Humeri, already described. The tuberosity of the olecranon, and the small inferior head, with its styloide apophysis, remain for a long time epiphyses in some subjects.

Connection.

660. It is connected with the pulley of the Os Humeri by an angular ginglymus; with the two extremities

extremities of the radius, by a compound lateral ginglymus, and with the hand by ligament, and not by articulation.

661. the situation of this bone may be considered two ways, either when the fore-arm is extended, and lies along the side of the trunk, or when it is bent, and lies on the lower part of the breast. The first situation appears to be most commodious for determining what parts of the bone are to be called *anterior, posterior, superior, inferior, external, and internal*. But the second seems most natural, as being the most common in living bodies, whether sitting or standing, and has accordingly been followed by some of the ancients. I shall have occasion to say something more upon this head, in describing the radius and bones of the hand.

Situation in particular.

§ 5. *The Radius.*

662. The radius is nearly of the same length with the ulna, bigger at one end than at the other, irregularly triangular, a little bent, and situated along the side of the ulna. Its name is taken from the resemblance it bears to the spoke of a wheel.

Size, figure, and situation in general.

663. We are to consider in this bone two extremities, and a middle portion. One extremity is small, and like a kind of head set upon a neck; the other is large, resembling a pedestal or basis; and therefore it might be divided into a head, body, and basis.

664. The head or small extremity of the radius is very short or low, the top of it is concave, and the circumference cylindrical; and both the glenoid cavity and circumference are covered with the same smooth shining cartilaginous crust; and about one quarter of the circumference is broader than the rest. The neck is small, and its situation a little oblique. It ends by a lateral tuberosity which lies directly under the broad part of the head, being rough in the middle and on one side, and smooth and superficially cartilaginous on the other.

Division.

665. The basis or great extremity of the radius is much broader than it is thick, and has two broad sides and one narrow. One of the broad sides is a little hollow and pretty even; the other is unequally convex, and divided by longitudinal eminences, or bony lines, into three or four longitudinal

dinal channels, much more distinct in fresh bones than in the skeleton. The narrow side is hollowed lengthwise, and between it and the other two, two angles are formed, by which the three sides are distinguished, and opposite to it, the other two meet in a third angle. This narrow side ends in a semilunar cavity bordered with a smooth cartilage, and lying almost in the same direction with the tuberosity. The broad sides end at their common angle, by an obtuse point or production, which has been called *the styloide apophysis* of the radius, and is really a continuation of one of the bony lines already mentioned.

666. The whole basis ends in an oblong, triangular, glenoid cavity, the cartilage of which is continued over the hollow edge of the narrow side. This is an articular cavity resembling an arch, and ending on one side at the styloide apophysis, and hollowed on the other by the cavity of the narrow side. It appears divided into two portions by a small transverse line, and in the natural state the hollowed side is lengthened out by a cartilaginous production, the description of which belongs to the history of fresh bones.

667. The middle or body of the radius is a little incurvated, the concavity lying between the tuberosity in the head and semilunar cavity in the basis. It has three sides; one rounded, which is the convex side of the curvature, and two concave: three angles, two of which are obtuse, distinguishing the two concave sides from the convex; and the third sharp, lying between the two concave sides, opposite to the convex side. In each of these sides there are several muscular marks.

Substance. 668. The substance of this bone is like that of the ulna. The head and basis are epiphyses in children, and in some subjects remain such for a long time afterward.

Connection. 669. The radius is connected with the ulna, Os Humeri, and carpus. It is articulated with the ulna, at its two extremities, by a double lateral ginglymus; the cartilaginous circumference of the head turning in the small sigmoide cavity, and the semilunar cavity in the basis turning upon the small head at the lower extremity of the other bone; and thus the small extremity of one bone is joined to the great extremity of the other.

670. It

670. It is articulated with the Os Humeri, by the application of the cavity in the top of its head, to the small head, at the lower extremity of the other bone. By this conformation it would be capable of moving in all directions; but as it is tied to the ulna at both extremities, its motions on the small condyloide head at the lower extremity of the Os Humeri, are confined to two kinds; that of rotation when it turns on the sides of the extremities of the ulna, and that of flexion and extension, in common with the ulna; and both these motions may be performed at the same time.

671. The articulation of the radius with the bones of the carpus, shall be explained in describing these bones.

§ 6. *The bones of the hand; and first, the bones of the carpus.*

672. The hand is the last part of the upper extremity, and is divided into the carpus, metacarpus, and fingers, as has been already said in the enumeration of the bones of the skeleton. It may be further divided into the concave and convex side.

Situation in general, and division of the hand.

The concave side is likewise called *the inside*, because it is commonly, and as it were, naturally turned toward the body, and so hid. The convex side is, for the same reason, named *the outside*, as being for the most part turned outward and exposed to view. The first is also named the *hollow* or *palm* of the hand; the other, the *back* of the hand.

673. The carpus or wrist consists of eight small, unequal, and irregular bones; and taken all together, they represent a sort of grotto of an irregular quadrangular figure, and connected principally with the basis of the radius. Considered in this manner, the whole collection of them has two sides, and four edges. One of the sides is convex and external, the other concave and internal. The convexity of the outside is pretty uniform, but the inner or concave side has four eminences, one at each corner. One of the four edges touches the fore-arm, and is, as it were, the head of the carpus; another edge may be termed *the basis*, and touches the metacarpus; the third is toward the point of the radius; and the fourth toward the point of the ulna. The first of these last I shall call *the small edge*, the other *the great edge*.

Situation in general, and division of the carpus.

674. The

674. The bones of the carpus are divided into two rows; the first of which lies next the fore-arm; the second next the metacarpus. Each row consists of four bones, but the fourth of the first row lies, in a manner, out of its rank. Each bone has several cartilaginous surfaces, for their mutual articulations; and in some of them for their articulations with the radius, and bones of the metacarpus, and thumb.

675. It is to no purpose to distinguish the three ordinary dimensions in any of these bones except one; but in most of them we may consider six sides; one external, turned toward the convex surface of the carpus: one internal, toward the concave surface; one towards the fore-arm, which I call *the brachial side*; one toward the fingers, which I call *the digital side*; one towards the point of the radius, or the radial side; and one towards the point of the ulna, or the cubital side.

676. Of these sides some are bony, other cartilaginous or articular. These last I shall call *sides*, the other *surfaces*, as being portions of the common surface of the carpus in its natural situation.

677. To distinguish these eight bones from each other, they are called *first*, *second*, *third*, and *fourth bones* of the first or second row, beginning to count from the radius or thumb.

678. Lyserus has been at pains to give a particular name to each of them. He calls the first bone of the first row *Os Scaphoides*, or *Naviculare*; the second, *Os Lunare*; the third, *Os Cuneiforme*; the fourth, *Os Pisiforme*: the first bone of the second row, *Os Trapezium*; the second, *Os Trapezoides*; the third, *Os Magnum*; and the fourth, *Os Unciforme*.

Os Scaphoides. 679. The first bone of the first row is termed *Scaphoides* in Greek, and *Naviculare* in Latin, from its resemblance to a small boat. Next the radius it has a convex side, by which it is articulated with the basis of that bone and a tubercle, which is one of the four eminences on the concave side of the carpus. Toward the thumb it has two half-sides, one large one, for the *Os Trapezium*, and a small one, for the *Os Trapezoides*. It has likewise a hollow side for the *Os Magnum*, and a small semilunar side, for the *Os Lunare*. The inner and outer surfaces are rough.

680. The second bone of the first row is called *Lunare*, because one of its sides is in form of a crescent. The articular sides in this bone are four in number; one convex for the basis of the radius; one semilunar, for the *Os Scaphoides*; one almost triangular, for the *Os Cuneiforme*; and one hollow, which, with the hollow side of the *Os Scaphoides*, forms a cotyloide cavity for the head of the *Os Magnum*. The convex side, together with that of the *Os Scaphoides*, forms an oblong convexity answering to the oblong concavity in the basis of the radius. The outer and inner surfaces are small and rough. This bone would be better named *Os Semilunare*. *Os Lunare.*

681. The third bone of the first row, called *Cuneiforme*, from its figure, appears rather like a wedge sticking between the two rows. It has a rough surface with a small tubercle upon it, which forms the greatest part of the cubital edge of the carpus; and four articular sides, whereof one is convex, which completes the articular convexity of the carpus; one orbicular and internal, or on the concave side of the carpus, on which the *Os Pisiforme* is set; and two which make an angle between them, one for the *Os Semilunare*, and the other for the *Os Unciforme*. *Os Cuneiforme.*

682. The fourth bone of the first row called *Orbiculare*, *Pisiforme*, and *Lenticulare*, from its figure and size, is irregularly round. It has but one cartilaginous side irregularly orbicular, the border or circumference of which represents a sort of narrow collar. The rest of the bone is rough, convex, and irregularly round, making one of the four eminences on the concave side of the carpus. This bone and the *Os Cuneiforme* may be supposed to make a third row distinct from the other two. *Os Orbiculare.*

683. The four bones of the second row lie all in a line, the first being articulated with the thumb, the rest with the metacarpus.

684. The first bone of the second row is named *Trapezium*, as being supposed to be of an unequal square figure. Its outer surface is rough, and makes a portion of the convex side of the carpus. On its inner surface is an oblong eminence, which makes one of the four eminences on the concave side of the carpus; and on the

same side it has a groove or channel. There is likewise a small tubercle on the outer surface.

685. It has several articular cartilaginous sides, *viz.* one brachial, one digital, and two cubital sides.

686. The brachial side, which is hollow, is articulated with the Os Scaphoides; the digital, with the first phalanx of the thumb; one of the cubital sides, with the Os Trapezoides, and the other with the first bone of the metacarpus.

687. The side which is articulated with the first phalanx of the thumb, appears to be made up of two superficial sigmoide or semilunar half-sides, distinguished by an eminence of the same figure, being each more hollow toward the sides than at the middle, which makes a portion of a sort of superficial pulley with the edges much worn.

688. One of the cubital sides which is articulated with the Os Trapezoides is large; the other which joins the first metacarpal bone is small.

689. The second bone of the second row deserves the name of *Pyramydale*, rather than *Trapezoides*; being a kind of pyramid with the point broke off. Its basis makes a portion of the outer or convex side of the carpus, and its point a part of the concave side.

690. It has several articular sides, *viz.* one brachial, which is the least of all, and articulated with the Os Scaphoides; one digital, of a considerable length, notched on each side and divided into two halves, by a sort of middle line or angle, which gives it the appearance of a pulley, articulated with the basis of the first metacarpal bone; one radial, irregularly triangular, and articulated with the Os Trapezium; and one cubital, a little hollow and articulated with the Os Magnum.

691. The third bone of the second row, called *Os Magnum*, is the largest of all the bones of the carpus. It is of a considerable length, and has a kind of articular round head, which is received into the cotyloide cavity formed by the two first bones of the first row; and this articulation is capable of a small degree of flexion and extension.

692. The digital side is a cartilaginous basis, unequally and obliquely triangular, the apex being turned inward. It is articulated with the second metacarpal bone, and is also a little

little notched on the radial edge for its articulation with the small edge of the first metacarpal bone.

693. The radial side is very small and near the basis, being articulated with the Os Pyramidale; the rest of this surface is without cartilage. The cubital side is double, answering to a like side in the Os Unciforme with which it is articulated.

694. The outer surface which forms a portion of the convex side of the carpus, is broad, rough, and uneven, for the insertion of ligaments. The inner surface is likewise rough, but narrower, and round both surfaces are several depressions which in the natural state are filled with small glands, ligaments, &c.

695. In the fourth bone of the second row, we are to consider the body and hooked or unciform apophysis, from whence it has the name of *Unciforme*. *Os Unciforme.* This apophysis, one of the four eminences on the concave side of the carpus, is flat, and the hollow side of its curvature turned towards the Os Magnum.

696. The outer surface of its body is rough, and, in some measure triangular. It completes the convex side of the carpus, and toward the ulna, terminates in a small tuberosity, which is all the cubital side of this bone.

697. It has three articular or cartilaginous sides, one radial, one brachial, and one digital.

698. The radial side is double, answering to the cubital side of the Os Magnum. The brachial side is very oblique, some part of it being gently concave, the rest gently convex, answering to the digital side of the Os Cuneiforme. The digital side is double, or distinguished into two halves, by a sigmoid angular line, for its articulation with the two last bones of the metacarpus.

699. The bones of the carpus are articulated with each other by arthrodia; but the first row forms a sort of ginglymus with the second, because the head of the Os Magnum may turn in the cotyloide cavity of the first row, while the two first bones of the second row slide upon the digital side of the Os Scaphoides, and the Os Unciforme in the same manner on the Os Cuneiforme.

700. When all these bones are in their natural situation, a

transverse depression is formed on the convex side of the carpus, by which the two rows are distinguished. This depression appears most between the Os Scaphoides and the three last bones of the second row, and looks like a kind of fold by which the second row is thrown back upon the first. The four eminences on the concave side of the carpus, are for the insertion of a strong transverse ligament. The inner substance of all these bones is spongy, and their surfaces are not very compact.

§ 7. *The bones of the Metacarpus.*

701. The metacarpus is the second part of the hand, situated between the carpus and fingers. The ancients, who called the carpus *brachiale*, from whence the word *bracelet* seems to be derived, termed the metacarpus, *post-brachiale*.

702. The metacarpus consists of four bones, one side of which forms a broad cavity, called *the palm of the hand*; the other, a gentle convexity, called *the back of the hand*. The ancient anatomists reckoned five bones in the metacarpus, including that bone which is now looked upon as the first phalanx of the thumb.

703. The bones of the metacarpus are long, thicker at the extremities than at the middle, and of unequal length and bigness. The first is the largest, the rest are lessened by degrees in all their dimensions. The two first are sometimes, though very rarely, equal.

704. Each bone is divided into the extremities and middle part; or into a basis, body, and head. The bases are angular, and turned toward the carpus; the heads rounded like condyles, and turned toward the fingers. Both are covered with cartilages, and the heads remain for a long time very distinct epiphyses.

705. The bases are narrow and almost angular toward the palm of the hand; toward the back of the hand their breadth is considerable, but on the other two sides they are very broad; and there they have small articular sides, which I call *lateral sides*. The heads are flattened on the two sides, which answer to the lateral sides of the basis, and their greatest convexity is turned toward the palm of the hand, terminating in two obtuse points. Several notches and fossulae break

in upon the lateral sides, and the flat sides of the heads are a little depressed, a small tubercle arising in the middle of each depression.

706. The body of each bone is contracted, of a triangular figure, and distinguished into three sides, whereof one is external and a little convex, contributing to make the back of the hand; the other two internal and a little concave, one being turned obliquely toward the radius, the other toward the ulna. These three sides are separated by the same number of angles, and that angle which parts the two internal sides is sharp. It is by these two sides and the angle between them, that the hollow of the palm of the hand is formed.

707. The first bone of the metacarpus is longer, thicker, and bigger than any of the rest, and supports the fore finger. Its basis is a little hollow, answering *First bone.* to the digital side of the Os Pyramidale of the carpus. On the outer edge there is a small angular notch, and on the cubital edge of the basis a small lateral side which is articulated with the basis of the second bone. The inner edge is terminated laterally by an oblique angle, which is articulated with the neighbouring angle in the basis of the Os Magnum. Round the basis are inequalities and depressions for the ligaments and articular glands. The outside of the body of the bone is broader toward the head than toward the basis.

708. The second bone of the metacarpus supports the middle finger, and has this peculiar to it, that its basis is very oblique, terminating at the outer *Second bone.* edge, by an angular point turned toward the first bone. By the triangular side of its basis, it is articulated with the basis of the Os Magnum, and by its lateral sides with those of the first and third bone of the metacarpus.

709. The third bone of the metacarpus supports the ring-finger, being less than the first and second. Its *Third bone.* basis is irregularly triangular, and proportionably less than the two former; and by the principal side thereof, it is articulated with the first half of the side of the Os Unifforme. The small lateral sides of the basis join those of the second and fourth bone of the metacarpus.

710. The fourth bone of the metacarpus supports the little finger. The principal side of its *Fourth bone.* basis, instead of being triangular, as in the other bones, is all

all of an equal breadth, a little oblique, and some part of it gently convex, the rest gently concave, and articulated with the second half of the side of the Os Unciforme. By its lateral side it joins the corresponding side of the basis of the third bone, but in a much looser manner than in the other articulations of the like kind. In the opposite side there is a small tuberosity.

§ 8. *The bones of the fingers.*

711. The fingers make the third part of the hand, and terminate the whole upper extremity. They
Situation, number, figure, and size. are five in number in each hand, called *the thumb, the fore-finger, the middle finger, the ring-finger, and the little finger.*

712. They may be said in general to represent the same number of compound, long, small, bony pyramids, convex on one side, gently concave on the other, and joined by their bases to the carpus and metacarpus, from whence they diminish gradually, and end in a sort of small heads.

713. The thumb is the biggest of all the fingers; next to that is the third, called *the long finger*. The second and fourth are shorter than the third; the fourth being a very little longer than the second. The fifth is the smallest of all.

714. Each finger consists of three pieces, called *phalanges*; the first of which is longer and thicker than the
Division. second, and the second, than the third. Each phalanx is divided in the same manner as an entire finger, into a basis, middle portion, and head; into two sides, one convex, the other concave; and into two edges. The basis of the phalanges remain epiphyses for a long time, as well as the heads of the metacarpal bones.

715. The first phalanx of the thumb is not like those of the other fingers. Ancient authors reckoned it
First phalanx of the thumb. among the bones of the metacarpus, which it resembles very much, and then they counted five metacarpal bones, allowing only two phalanges to the thumb. The convex side of this phalanx is very much flattened, and broader toward the head than toward the basis. On the concave side is a kind of angular line, which,

in some measure, distinguishes it into two parts. Its head is like those of the metacarpal bones, only flattened at top.

716. The articular side of its basis is proportioned to the digital side of the Os Trapezium of the carpus; and framed in such a manner as that the sigmoide cavities and eminences in both bones cross each other. This articulation has something very particular in it. It is a kind of double ginglymus which readily allows of flexion and extension, adduction and abduction, but with difficulty permits the oblique motions, because then the two sides run counter to each other.

717. The head and basis carry for a long time the marks of epiphyses; and for all these reasons, this bone may be reckoned a metacarpal bone degenerated.

718. The second phalanx of the thumb is shorter than the first; its body convex or semi-cylindrical on one side, flat on the other, and contracted *Second phalanx.* between the edges. The articular side of the basis is gently concave, and surrounded near the edges by small tuberosities, as also near the angle of the phalanx. The head is a regular portion of a pulley, which projects more on the concave than on the convex side; and on each side of it there is a small fossula, and some inequalities in form of tubercles. On the flat or concave side of the phalanx are two rough lines, one near each edge, which are often destroyed in cleaning the bones. They are the impressions or marks of the articular vaginæ, which shall be explained in describing the fresh bones.

719. The connection of this phalanx with the first, is by a kind of arthrodia, or by a flat enarthrosis, which permits a motion in several directions, though more limited than in other articulations of the same kind. It is articulated with the third by a very perfect ginglymus.

720. The third phalanx of the thumb represents the half of a sort of cone, cut lengthwise, and by joining it to the same bone of the other thumb, *Third phalanx.* an entire cone is formed. The convex side is more even than the flat side, and on each edge, there is a tuberosity near the basis. The basis has two hollow sides, which form a ginglymus, with the head of the second phalanx. The head

head is small and flat, ending in a rough semicircular border, which on the flat side of the bone represents a horse-shoe.

721. The other four fingers in general, and their phalanges in particular, are all nearly of the same structure, differing chiefly in size. The fore and ring-fingers are almost equal, only the fore-finger is generally a little bigger, and sometimes a little shorter than the other. The middle finger is the longest, and the little finger the least. Almost the same proportions are to be observed in the phalanges.

The other four fingers.
722. The first phalanges of these four fingers are made nearly in the same manner with the second of the thumb; only they are longer in proportion, flatter on the concave sides, and more rounded on the convex sides. The edges of the flat sides have the same rough line as the second phalanx of the thumb. Their bases are more hollow, for their articulation with the heads of the metacarpal bones, and their heads are like pulleys, as in the second bone of the thumb.

First phalanges.
723. The second phalanges are shorter, narrower, and thinner than the first. Both phalanges are gently incurvated, and resemble each other in structure, except that the second contract by degrees from their bases to the heads, which are very small; and that their bases have a double cavity for their articulation by a ginglymus, with the heads of the first phalanges. Their flat sides have the same rough lines already mentioned.

Second phalanges.
724. The third phalanges are in every thing like that of the thumb, except that they are smaller, each of them being proportioned to the fingers they belong to.

Third phalanges.
725. It is to be observed concerning all the phalanges, that their bases have small tuberosities, and their heads, except those of the last phalanges, have on each side a roundish sort of fossula, bordered with small eminences.

§ 9. *The particular situation and uses of the bones of the upper extremity.*

726. The hand is generally represented in skeletons and figures as lying in the same plane, and in the same longitudinal

dinal direction, with the bones of the fore-arm. This gives a very false idea of its true situation, which, with respect to the fore-arm, is oblique in two respects. The back of the hand is inclined upon the convex side of the carpus, and makes an angle with the fore-arm, and besides, the fourth bone of the metacarpus is inclined towards the ulna in particular. In a word, the breadth of the hand makes an angle with the breadth of the fore arm, and the thickness of the hand at the same time with the thickness of the fore-arm. I mean here that part of the fore-arm which is next the hand.

727. This is owing to the structure and situation of the bones of the carpus, and to their connection with those of the fore-arm. First, the two rows of these bones make a sort of transverse fold on the convex side of the carpus; and the articular brachial sides of the two first bones of the first row are turned a little toward the same convex side of the carpus; which obliges the whole hand to be a little bent back in its natural situation. Secondly, the edge of these bones next the ulna is much shorter than that next the radius, which makes the cubital edge of the whole hand incline to that side.

728. By not considering this, a large void space is commonly left in skeletons, between the extremity of the ulna and the Os Cuneiforme of the carpus. It ought likewise to be observed, that the edge of the metacarpus next the ulna is shorter than the other, so that in the metacarpus a small and great edge may as justly be distinguished, as in the carpus.

729. In this oblique and natural situation of the hand, the fingers being extended and a little separated, the extremity of the fore-finger will be found to answer to the interstice between the bones of the fore-arm; and if in this situation we make alternately the motions of pronation and supination, the extremity of the fore finger will be found to be in some measure the common centre of these motions.

730. This disposition of all the bones of the hand is moreover very well contrived, to give it several kinds of attitudes; for, by means thereof, it may be lengthened, flatted, shortened, and contracted. The hand is lengthened or widened, and flatted, by extending all the fingers and turning

back the thumb, which is what is called *extending* or *opening* the hand. It is shortened by bending all the fingers, whether in what is called *closing the fist*, or in grasping any thing; and to this the situation of the thumb, and the oblique disposition of the bones of the metacarpus and fingers, contribute in a particular manner. And as in this case, the thumb counterbalances all the other fingers, the articulation of the first phalanx thereof with the Os Trapezium appears to be rendered more firm and steady, by partaking a little of the nature of a ginglymus, without hindering its other motions. Lastly, the hand is contracted, and made into a sort of gutter or furrow, by the adduction of the thumb, and the easy motion of the fourth metacarpal bone already mentioned. And if at the same time we bend the fingers and press them close together, we both shorten and contract the hand, and thereby form a hollow, which is called *Diogenes's cup*.

731. In the fingers we ought likewise to remark, that though the articulation of the second phalanx of the thumb and first phalanges of the other fingers be moveable in many directions, and framed nearly in the same manner as that of the Os Humeri with the scapula, yet these phalanges cannot be moved round their axes. This is not owing to their conformation, but to the want of proper muscles, as we shall see afterwards. The same thing cannot be said of the first phalanx of the thumb, because though it had proper muscles, yet the kind of half-ginglymus, by which it is articulated, would not allow of such a motion.

732. The thumb is situated differently from the other fingers. The fingers, both with respect to their sides and edges, have in their natural situation nearly the same direction with the plane of the metacarpus. The thumb being in its natural situation, and free from the action of all its muscles, its convex side answers to the convex side of the radius, and its flat side is turned toward the little finger; and the first phalanx makes an hollow angle with the radius, and a prominent angle with the second phalanx; but both this and the third phalanx lie in a straight direction, like that of the fore-arm.

733. The carpus is the basis and centre of all the motions of the hand, except that of rotation. By means thereof we can bend the hand in all directions, but with more ease toward

toward the sides and edges, than any other way. The four bones of the second row may have a small degree of motion on the first, such as a ginglymus can allow of.

734. The radius is in a manner the handle of the hand, and it is chiefly by means thereof, that we can move the hand reciprocally as on an axis, turning either edge of it toward the body. When the radial or great edge is turned to the body, this motion or attitude is termed *pronation*, and when the cubital or small edge is toward the body, it is termed *supination*. In the natural and most ordinary situation of the hand, the palm is turned toward the body, and not the edges.

735. This disposition of the hand determines the true situation of the radius, which is not on one side of the ulna in a parallel direction, as the figures and skeletons commonly represent it; but the radius crosses the ulna obliquely in such a manner, as that the styloide apophyses in both bones are directly over-against each other. This is its true natural situation. The radius being bent, may be still further crossed over the ulna, than in its natural situation, and this happens in pronation; but in supination it is parallel to the other bone.

736. The ulna supports the handle of the hand, without being itself articulated with the hand. Two lateral ginglymi and very strong ligaments connect the radius closely with it, so that in the most violent motions these two bones cannot be separated. When we push or press any thing with the hand, the whole force is sustained by the radius, the basis of which supports the wrist, and its concave head is strongly pressed against the small inferior head of the Os Humeri. The oblique direction of the pulley of the ulna is the reason that in bending the fore-arm upward, the extremity of that bone is naturally turned towards the thorax, and not without difficulty toward the articulation of the scapula.

A R T. V.

The bones of the lower extremities.

737. **T**HE inferior extremities are two in number, situated laterally below the trunk, which both supports and is supported by them according to the different situations of the body. Each extremity is divided into the thigh, leg, and foot. In describing the situation of all these bones, I suppose the subject to be standing.

§ 1. *The Os Femoris.*

Size and figure. 738. The thigh-bone is the biggest and longest bone of the skeleton. Its figure comes near that of a cylinder, and it is a little bent at the middle.

Situation in general. 739. It lies in the same direction with the trunk; only a little obliquely, in such a manner, as that the upper parts of the two bones are at a greater distance from each other than the lower.

Division. 740. It is divided into the upper, middle, and lower parts, or into the body and two extremities.

Upper extremity. 741. In the upper extremity we are to consider the head, neck, and two tuberosities; one named *the great trochanter*, the other, *the little trochanter*.

742. The head is rounded like a portion of a globe or ball, and covered with a very smooth cartilage. Its situation is obliquely outward, and a little forward, so as that the greatest portion of its convexity lies in the upper part, and the smallest in the lower part, and the cartilage extends further on the fore and back sides, than on the other sides.

743. A little below the middle of its convexity there is a fossula nearly of a semilunar figure, in which a ligament is inserted in the natural state. This head is an epiphysis in children, and in some subjects remains such for a long time, and

and is therefore liable to be separated from the neck by any violent force.

744. The neck is an apophysis, situated interiorly at the upper part of the bone being inclined upward, and a little forward, and making an angle with the body more or less oblique, but in some subjects it lies almost transversely. Towards the lower part it expands into a kind of basis; and at its middle narrow part, we observe a rough superficial impression, which furrounds it like a collar.

745. The great trochanter is a large tuberosity lying on the exterior and a little toward the posterior part of the basis of the neck. It is very high, and turned a little backward, terminating in an obtuse point in which there is a cavity or fossula. Its convexity is unequal, and distinguished into several surfaces, which are muscular impressions; and the like impressions are found on its edge and concave side.

746. The little trochanter lies on the posterior and inferior part of the basis of the neck, being turned inward.

747. Between the two trochanters posteriorly, there is an oblong, oblique eminence, which is a sort of communication between them, and lengthens out the cavity behind the great trochanter. Anteriorly there is likewise a broad oblique line, sometimes considerably raised, which runs between the two apophyses, and terminates the basis of the neck on the fore part.

748. The lower extremity of the Os Femoris is broad and thick, being, as it were, the basis of the whole bone. We observe in it two large articular eminences situated laterally with respect to each other, which are separated, and very prominent on the backside, but united like a pulley on the fore side. They are called *condyles*; and with respect to the length of the body of the bone, the internal condyle is longer, and reaches lower than the other; but regard being had to the obliquity of the bone, there is very little difference between them, both being nearly in the same horizontal plane.

749. The external condyle is broader, and advances more forward than the other. They are covered with a smooth cartilage, and though they both make but one body, they are in some measure distinguished on the fore and lower sides by a su-

a superficial depression, after the manner of a pulley, and behind they are parted by a deep round fossa.

750. In this large fossa or notch there are several small holes; and likewise two superficial and pretty broad femilunar impressions, one at the lower edge of each condyle; that on the internal condyle being situated a little forward, and the other a little backward.

751. On the side of each condyle there is a tuberosity, and behind that a muscular impression, together with a small cartilaginous surface on which lies a kind of sesamoide bone, as we shall see in describing the muscles.

752. The body or middle portion of this bone represents a pillar or cylinder bent forward. We may however distinguish three sides in it, one anterior, which is more rounded in the middle than in the upper and lower parts; and two posterior, more flat than the former, and separated by a long angular ridge, called *linea aspera*, which is rough, unequal, and very prominent, and seems to arise from both trochanters. On the outside of this ridge, toward its upper part, there is a rough longitudinal mark, a little depressed toward its lower extremity. Below the *linea aspera* is divided into two, each running in the direction of the condyles; but being soon lost after the division, a flat triangular surface, very broad near the condyles, comes in its place. The external line is more prominent than the internal, till they both vanish.

753. There is likewise another oblique unequal line, before and under the little trochanter, which, as it descends, unites with the *linea aspera*. All these lines, ridges, and depressions are for the insertion of muscles. About the middle of the bone on the back part we see sometimes one hole, sometimes more, for the passage of blood-vessels and nerves.

754. The natural direction of the Os Femoris is not perpendicular, but oblique, the superior extremity being inclined outward, the inferior extremity inward; so that the two bones, as has been already said, are at a greater distance above than below; and from hence we see the reason why the internal condyle appears to reach lower down than the external, when we view a single bone.

Situation in particular.

775. This

755. This bone is spongy at the extremities, and hollow in the middle; the cavity being filled with reticular substance and portions of laminae detached from each side. *Substance.*

756. It is articulated above by enarthrosis with the Os Innomina-
tum, its head being received into the acetabulum; below, it is connected with the tibia by a particular kind of ginglymus, of which hereafter. *Connection.*

§ 2. *The bones of the leg; and first, the Tibia.*

757. The leg is the second part of the lower extremity, situated perpendicularly between the thigh and the foot, and consisting of two large bones called *Tibia* and *Fibula*, and a small one called *Patella*.

758. The tibia is a long bone irregularly triangular, and much larger at top than below. Its name is taken from the resemblance it bears to a kind of pipe or flute used by the ancients. It is divided into two extremities and a middle part, or into the head, body, and basis. *Figure and division of the tibia.*

759. The upper extremity or head of the tibia consists of two condyles, the upper side of which is flat and divided into two cartilaginous surfaces, almost horizontal, and a little hollow, one internal, the other external. Between these lies a cartilaginous tuberosity, which appears to be double, and has inequalities both on the fore and back part, for the insertion of ligaments. The two surfaces answer to the two condyles of the Os Femoris. The internal is something oblong from before backward, and a little more depressed than the other. The external is rounder, and descends a little backward. The whole head taken transversely is oval, except towards the back part, where there is a superficial notch; and the circumference is very rough. *Upper extremity.*

760. The external condyle is more prominent than the internal, and on its lower part, a little backward, there is a small cartilaginous surface for the articulation of the fibula. On the fore part of the head there is an unequal tuberosity, called

called *the spine* of the tibia, for the insertion of the tendinous ligament of the patella.

761. All that part of the head which lies above the level of the spine is epiphyses in children; and the spine is originally an epiphysis distinct from the other; but it afterwards becomes an apophysis of the head of the tibia.

762. The lower extremity is neither so thick nor so broad as the upper. It may be looked upon as the basis of the bone, and on its outside there is a longitudinal depression, broader at the lower than at the upper part, which receives the end of the fibula. On the inside of the basis there is an apophysis called the *inner angle*, which runs down lower than any other part, and has towards its posterior side a groove or channel, for the passage of a particular tendon.

763. The basis of the tibia terminates in a transverse oblong cartilaginous articular cavity, the capacity of which is increased on the inside by the inner angle, the cartilage being likewise continued over that side of it, which is turned toward the cavity. Through the middle of this cavity a superficial eminence runs, by which it is divided into a right and a left portion.

764. All the inferior portion of the basis of the tibia, together with the angle, is epiphyses in children, and the marks thereof remain for a long time after the ossification is perfected.

765. The greatest breadth or longest diameter of the basis of the tibia does not lie in the same plane with that of the head, the angle lying a little more inward than the internal condyle. This observation is of great consequence in fractures and luxations.

766. The body of the tibia is in a manner triangular, being distinguished into three sides, one internal, one external, and one posterior; and into three angles, one anterior, called *the crista* of the tibia, and two posterior.

767. The inner side is the broadest of the three, very equal, gently convex, and turned a little forward. The outer side is unequally flat, and narrower than the former. The backside is unequally rounded, and the narrowest of all. At its upper part, however, it is of a considerable breadth, and there

there we observe a long oblique muscular impression, beginning under the notch in the posterior part of the head, and from thence running downward toward the inner side. Immediately below the extremity of this impression there is another less oblique.

768. The anterior angle, called *crista*, is sharp, prominent about the middle, and almost round at the lower part. It might be reckoned a continuation of the tuberosity or spine. The internal posterior angle is something rounded; the external is more acute, except toward the upper part, where it is more or less flattened.

769. The substance of the tibia is the same with that of the other long bones. It is connected above, *Substance and connection.* with the condyles of the Os Femoris, by an articulation which is partly a ginglymus, for the extension and flexion of the leg, and partly an arthrodia for the rotation of the leg when bent. This is owing to two intermediate cartilages, which shall be examined in the description of the fresh bones.

§ 3. *The Patella.*

770. The patella is a small bone, situated above the spine of the tibia, resembling a large chestnut. It is about half as thick as long, and *Situation in general, figure, and size.* its length and breadth are nearly equal.

771. It is divided into a basis, apex, and two sides, one convex, the other concave. The basis is the superior, and thickest part of the bone, and is *Division.* marked with a very considerable muscular impression, which runs down for a little way on the convex side. The apex is obtuse, and serves for the insertion of a strong ligament, which ties the patella to the spine of the tibia.

772. The anterior side is convex, with some small inequalities and furrows upon it. The posterior side is concave, covered with a cartilage reaching near the apex, and terminating at an unequal cavity or fossula, which is an impression for the ligament already mentioned. This cartilaginous side is parted in two by a ridge which goes between the basis and apex; and the two parts are exactly suited to the pulley of

the Os Femoris, the external part being broader than the internal, which is likewise observable in the pulley.

773. The patella remains long cartilaginous, and in ossifying, it becomes entirely cellulous, except the
Substance. surfaces of its two sides and the impressions.

774. It is connected with the tuberosity of the tibia by a thick strong ligament, and indeed I look upon it
Connection. as belonging in a particular manner to the tibia, or as a moveable olecranon, which again may be looked upon as a fixed patella. The reason of this difference in the two extremities shall be given in the history of the fresh bones and muscles.

§ 4. The Fibula.

775. The fibula is a small long bone, irregularly triangular, lying on the outside of the tibia, almost opposite to the external posterior angle, but a little more backward. It is divided into the upper extremity or head, middle portion or body, and lower extremity or basis.
Size, situation and division.

776. The upper extremity is a kind of tuberosity or head obliquely flattened by a small cartilaginous plane, by which it is articulated with the cartilaginous surface at the lower part of the external condyle of the tibia. It terminates backward by a kind of short blunt point directed upward.

777. The lower extremity is broader, flatter, and more oblong than the upper. It is partly a continuation of the body of the bone, and partly an epiphysis in children, the marks of which are quite lost in an advanced age. It has, in a manner, three sides, one rounded like a tuberosity, one flat, and the third narrow. When it is placed in the lateral cavity of the basis of the tibia, it makes the outer angle opposite to the inner angle. In its natural situation it reaches much lower down than the basis of the tibia, and ends in a point turned a little backward.

778. The flat side is cartilaginous, and turned toward the cartilaginous side of the inner angle, with which, and with the inferior side of the basis of the tibia, it completely forms the cavity by which the leg is articulated with the foot. The

narrow

narrow side is turned backward, and near its lower part is a small oblong unequal fossula, formerly believed to be for the passage of a tendon, in which a small mucilaginous gland is lodged. The point by which the basis of the fibula ends has a small smooth surface immediately below the narrow side, for the insertion of an annular ligament.

779. The body of this bone is long and small, more or less contorted, and irregularly triangular. Near the two extremities it contracts into a kind of neck, and a little below the middle it is often bent inwards; but this curvature seems chiefly owing to the method of dressing children, for we sometimes meet with this bone very straight. It is distinguished in an irregular manner into three sides, and three angles principally towards its lower part.

780. The outside is the most considerable. The upper half of it is more or less hollow; afterwards it grows round, and altering its direction, becomes almost posterior in the lower half. The posterior side is more or less convex toward the upper part; then it grows flat, and turning in the same manner as the former, becomes nearly internal toward the lower part. The inner side has likewise a turn below its middle, and becomes anterior from thence downward; and this turn is marked by an oblique line which runs down on this side from behind forward, and divides it into two. These sides serve partly for muscles to lie upon, and partly for their insertions.

781. The internal angle of the fibula answers to the external posterior angle of the tibia, and both serve for the insertion of the interosseous ligament of the leg. The other two angles are more or less sharp, especially the anterior, which is sometimes like a kind of crista, and terminates below, in a small triangular surface.

782. The internal structure of the fibula, though a very small bone, is like that of the other long bones. It is articulated by its upper extremity with the inferior surface of the external condyle of the tibia. This articulation is an arthrodia with a very small degree of motion. The inferior extremity is articulated by its cartilaginous side, partly with the lateral depression in the basis of the tibia, in the manner that shall be explained in the history of the fresh bones, and partly with the first bone

*Substance and
connection.*

of the foot, completing the ginglymus between the leg and that bone.

§ 5. *The bones of the foot; and first, the bones of the Tarsus.*

783. The foot is the third portion of the lower extremity, and is divided into three parts, the tarsus, metatarsus, and toes. The vulgar mention several other parts of the foot, such as the heel, the point, the upper part, the sole, the sides or edges, one internal, the other external, &c.

784. The tarsus consists of seven bones, much larger than those of the carpus, the names for which, in the order in which they are commonly described, are the *Astragalus*, *Os Calcis*, *Os Scaphoides*, *Os Cuboides*, and three *Ossa Cuneiformia*. According to their size they may be divided into three classes of large, middle-sized, and small bones. The *Astragalus* and *Os Calcis* belong to the first class; the *Os Scaphoides* and *os Cuboides* to the second; and the three *Ossa Cuneiformia* to the third.

785. The particular divisions of each of these bones, and indeed of all the bones of the foot, are much more easy than in the bones of the hand, because the foot remains always in the same attitude; and therefore the anterior, posterior, superior, inferior, lateral, and other parts may be certainly fixed, without any danger of mistaking.

786. According to the natural situation of the foot, and its connection with the leg, the *astragalus* is the superior and first bone of it. This bone may be divided into two portions, one large and posterior, which is, as it were, the body of the bone; and one small and anterior, which is an apophysis or the anterior portion.

787. The body or posterior portion has four sides, one superior, two lateral, and one inferior. The upper side is the largest, covered all over with a cartilage, cylindrically convex from before backward, with a depression running through the middle of its breadth, which represents half a pulley, and continuous with the two lateral cartilaginous sides, of which the external is broader than the other. This upper side is articulated with the lower side of the basis of the tibia, the internal lateral side, with the inner angle, and the external lateral side with the outer angle. Below the internal

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nal lateral side there is a great depression without cartilage, and several other inequalities.

788. The lower side is likewise cartilaginous and obliquely concave, for its articulation with the *Os Calcis*. At the very lowest and posterior part of the body of the astragalus, on the edge of the lower side, is a small, oblique, smooth notch or channel for the passage of tendons.

789. The apophysis or anterior part of the astragalus, is distinguished from the body by a small depression on the upper part, and on the lower, by a long, oblique, unequal notch, very broad toward the outside. The anterior side of this apophysis is all cartilaginous and obliquely convex, for its articulation with the *Os Scaphoides*. The lower side likewise cartilaginous is parted in two, and articulated with the *Os Calcis*, being distinguished from the lower side of the body of the bone by the long oblique notch already mentioned. Besides these two cartilaginous sides there is a third below the anterior, towards the inner part, which in the skeleton touches nothing.

790. The *Os Calcis* is the largest bone of the foot, of which it makes the posterior part, and, in some measure, the basis. It is oblong and very irregular, and may be divided into a body and two apophyses, one great and anterior, the other small, lateral and internal. *Os Calcis.*

791. The body of the *Os Calcis* has six sides, one posterior, one anterior, one superior, one inferior, and two lateral.

792. The posterior side is broad, unequally convex, and as it were divided into two portions, one superior, small, and polished; the other inferior, much larger, unequal, and rough, which in children is an epiphysis; and may be named the *tuberosity* of the *Os Calcis*. The lower part of it is bent downward, and terminates in two tubercles or obtuse points, which belong rather to the inferior than to the posterior side of the bone.

793. The upper side may be divided into two parts, one posterior and unequal, having a small depression; the other anterior, convex, and cartilaginous, proportioned to the great inferior cavity of the astragalus. This side is turned obliquely forward, and by this obliquity becomes part of the fore-side,

forefide, the remaining part of which is loft in the anterior apophyfis.

794. The lower fide is narrow, and behind it lie the two tubercles already mentioned, of which the internal is the biggest. They both ferve for the infertion of the aponeurofis in the fole of the foot, but chiefly the biggest.

795. The two lateral fides are continued over the anterior apophyfis. The external is gently convex and unequal, covered only by the common integuments and ligaments. The internal is hollowed and deprefsed.

796. The great or anterior apophyfis lies in the fame direction with the body, being a continuation thereof. It has five fides or remarkable parts, and were it not for the body, it would have a fixth.

797. The upper fide has an irregular and unequal deprefion, which together with that in the apophyfis of the aftragalus forms a confiderable foffula. At its anterior extremity there is a fmall cartilaginous furface answering to one of thofe in the apophyfis of the aftragalus.

798. The anterior fide of the apophyfis is broad, oblique, cartilaginous, partly convex and partly concave, and articulated with a like furface of the Os Cuboides. This is the forefide of the whole Os Calcis when confidered without any divifion.

799. The outfide of the apophyfis is very rough, being a continuation of the outer fide of the body, with a tubercle or eminence at the place where thefe two fides meet, which, however, is not found in all fubjects. On the lower part of this tubercle, is a cartilaginous furface for the paffage of the tendon of the peronæus longus. Sometimes we fee only fome fmall veftiges of this eminence, and often none at all. We fometimes meet with another fmall cartilaginous furface lower down and more forward, near the anterior extremity of the apophyfis, for the paffage of the fame tendon.

800. The lower fide is a tuberoſity continued from the fide of the body, and defigned for the infertion of mufcles.

801. The lateral apophyfis is almoſt common to the body, and to the great anterior apophyfis, and increaſes the cavity on the infide of the Os Calcis. On its upper part, it has a very ſmooth cartilaginous furface articulated with one of the inferior ſurfaces of the aftragalus. This apophyfis is very
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low down, and its inferior part is smooth for the passage of tendons.

802. The *Os Scaphoides*, called also *Os Naviculare* from its resemblance to a little flat boat, lies before the astragalus. It has two cartilaginous sides, an oval circumference, and a tuberosity. Its thickness is inconsiderable when compared with its other dimensions, and it lies as it were on its side, before the astragalus. *Os Scaphoides.*

803. The concave side is posterior, articulated with the anterior convex side of the astragalus. The anterior convex side is divided by two small lines into three planes for the articulation of the three *Ossa Cuneiformia*.

804. The circumference forms an oval, which contracts by small degrees, and terminates in an obtuse point. One side of this circumference is more convex and rough than the other, and the inequalities in it serve for the insertion of ligaments. The point of the oval ends in a tuberosity marked with a muscular impression. In the natural situation of this bone, the most convex side is uppermost, the other, lowest, and the tuberosity turned inward and downward.

805. By this situation, and the difference of the sides, it is easy to distinguish the *Os Naviculare* of the right foot from that of the left. The small or inferior convexity of the circumference has, near the tuberosity, a superficial notch, and on the opposite side, a small cartilaginous surface, and a small tubercle for its articulation with the *Os Cuboides*, and the insertion of ligaments.

806. The *Os Cuboides* is situated before the *Os Calcis*, on one side of the *Os Scaphoides*. It is a mass with six sides, all very unequal and very irregular; and from these it has its name. *Os Cuboides.*

807. The upper side is flat and rough, for the insertion of the ligaments which connect it with the neighbouring bones.

808. The lower side has an oblique eminence, and immediately below that, a canal or groove which is likewise oblique. The eminence divides this side into two, and is a little cartilaginous on that edge which touches the groove. The groove appears to be cartilaginous from a ligament which lines it, and both that and the edge of the eminence serve for

for the insertion of an annular ligament, and for the passage of the tendon of the peronæus longus.

809. The posterior side is cartilaginous, broad, oblique, partly convex and partly concave, answering to the anterior side of the Os Calcis.

810. The anterior side is pretty broad, and divided into two portions by a narrow prominent line, by which portions this bone is articulated with the third and fourth bones of the metatarsus.

811. The inner side is the longest of all. It has a small cartilaginous surface, by which it is articulated with one of the *Ossa Cuneiformia*. The rest is rough, with several depressions, in which vessels and glands are lodged. Behind the cartilaginous portion, there is in some subjects another narrow surface, which is articulated with the neighbouring portion of the circumference of the Os Scaphoides; this articulation, when wanting, is supplied by ligaments.

812. The outside is the least of all, irregular, short, and narrow, and it has a notch which communicates with the groove on the lower side.

813. The *Ossa Cuneiformia*, are three in number, situated before the Os Scaphoides, and they have their name from the resemblance they bear to wedges. The first is the largest, the third the least; and the second of a middle size between the other two. With the Os Cuboides they form a sort of arch which on the side next the other foot is high, and low on the opposite side.

814. In each bone we may distinguish the basis, apex, and four sides, one posterior, one anterior, and two lateral, whereof one is internal, the other external.

815. The first bone is like a wedge contorted and bent. Its basis is low down, unequally rounded, like an oblong tuberosity, serving for the insertion of a tendon.

816. The internal lateral side, or that which is turned toward the other foot, is unequally convex and rough for the insertion of ligaments.

817. The external lateral side, or that next the second bone, is unequally concave, and cartilaginous toward the superior and posterior edges. The largest portion of this side is articulated with the second bone; the rest toward the an-
terior

terior edge is joined laterally to the second bone of the metatarsus.

818. The backside is the least, cartilaginous, and almost triangular, suited to the first of the three triangular surfaces of the Os Scaphoides.

819. The anterior side is cartilaginous, large, and semilunar, the convex edge being turned to the other foot, and by this, the first Os Cuneiforme is articulated with the first bone of the metatarsus.

820. The angle is turned upward, and the obliquity thereof occasions the anterior side to be the highest, and the posterior, the lowest.

821. The second Os Cuneiforme, the least of the three, has the basis upward, and the angle downward, and resembles a wedge more than the first. Its basis is short and rough for the insertion of ligaments. The backside is cartilaginous, and perfectly triangular, suited to its articulation with the middle surface of the convex side of the Os Scaphoides. The anterior side is also cartilaginous, a little more oblong, and articulated with the basis of the second metatarsal bone.

822. The two lateral sides have, toward their superior and posterior edges, oblong cartilaginous surfaces, by which they are articulated with the first and third *Offa Cuneiformia*. The rest of these two sides is a little depressed, and thereby small interstices or void spaces are left between the bones. This is every way the shortest bone of the three. Its angle is hid between the other two bones of the same name, and does not reach so low as theirs, which makes this part of the foot a little hollow.

823. The third Os Cuneiforme, of a middle size between the other two, has likewise its basis upward and its angle downward. The basis is longer than that of the second, almost flat or very little convex, and rough for the insertion of ligaments. The angle runs down lower than that of the second bone.

824. The backside is cartilaginous and triangular, that is, of the same figure with the third surface of the convex side of the Os Scaphoides. The anterior side is likewise cartilaginous and triangular, but a little oblong, being articulated with the basis of the third bone of the metatarsus.

825. The internal lateral side is broad, with two cartila-

ginous surfaces, one toward the posterior edge, the other toward the anterior. The first is for its lateral articulation with the second Os Cuneiforme, the second for its lateral articulation with the basis of the second metatarsal bone.

826. The external lateral side is likewise broad, and toward its posterior edge has a large cartilaginous surface for its articulation with the Os Cuboides. Towards its anterior edge there is a sort of void space for the passage of vessels, and sometimes a little cartilaginous corner for its lateral articulation with the fourth bone of the metatarsus.

§ 6. *The bones of the Metatarsus.*

827. The metatarsus is the second part of the foot; and in some things it agrees with the metacarpus, and differs from it in others. It consists of five bones, whereas the metacarpus is reckoned to consist only of four, and it forms a sort of grate, inclined in the same manner with the arch of the Os Cuboides and Ossa Cuneiformia. These bones are distinguished only by the names of *first*, *second*, &c. and to them we may add two sesamoide bones commonly preserved in the skeleton, which belong to the great toe.

828. The bones of the metatarsus, like those of the metacarpus, may be divided into two extremities, and a middle part; or into the head, basis, and body. The heads are situated forward, the bases backward, and both are cartilaginous as in the hand. The bodies are triangular, but disposed in such a manner as that the parts called *external* and *internal* in the hand, are here the superior and inferior.

829. The first of the five metatarsal bones is the biggest and shortest of all. The four following are proportionably longer than in the hand, and their bases larger than the heads; so that, in their natural situation, the bases take up a greater space than the heads. The heads terminate, towards the sole of the foot, by two small productions, as in the hand. In these four bones the inferior angles of their bodies are turned obliquely outward, and their heads do not lie altogether in the same direction with their bodies. The basis of the first bone, and the heads of the other four, remain for a long time epiphyses; of which there are likewise some marks in the head of the first.

830. The basis of the first bone of the metatarsus has a semilunar circumference, the flat side being turned outward or toward the second bone of the same foot, and the convex side inward, or toward the other foot. One point of the crescent is turned upward, the other downward; and the whole basis is gently hollow, but broader toward the upper than toward the lower part. At the external edge or flat side of the basis, there is often a cartilaginous surface for its lateral articulation with the basis of the second bone; and at the lower part of the same side, precisely at the inferior point of the crescent, there is a very remarkable and very constant muscular impression for the insertion of the tendon of the peronæus longus. The circumference of the basis is a little raised, like a flat roll. *First bone.*

831. The head of this bone is thick, cartilaginous, and convex on the fore and lower part, but with this difference, that the convexity on the fore part is simple and even, but on the lower, resembles a double pulley, having two cavities and three eminences, *viz.* two edges, a channel near each edge, and an eminence between the two channels. The convexity in general is for the articulation of this bone with the first phalanx of the great-toe, and the double pulley for that of the two sesamoide bones already mentioned, and which shall be described after the toes.

832. The body of the bone is triangular, and very big, having three sides, two superior and one inferior. One of the superior sides is internal and rounded, the other external and gently concave, and the inferior side is flat. It has likewise three angles, one superior, and two inferior, one internal, the other external; on the lower part of which we see a sort of continuation of the tendinous impression of the peronæus longus.

833. The second bone of the metatarsus is the biggest of all. Its basis is large, triangular, and a little oblique, and the principal cartilaginous or articular side thereof is obliquely triangular, answering to the anterior side of the second Os Cuneiforme. On each side, near the basis, there is a cartilaginous surface for its articulations with the first and third Ossa Cuneiformia, between which this bone appears to be fixed. *Second bone.*

834. Besides these lateral surfaces, there are others on the anterior

anterior and upper part of the basis for its lateral articulations with the basis of the first and third bones of the metatarsus; so that this second bone is articulated with five others, viz. backward with the second Os Cuneiforme, on one side with the first Os Cuneiforme, and first bone of the metatarsus, and on the other side with the third Os Cuneiforme and third bone of the metatarsus.

835. Its head is rounded, and resembles pretty much that of the first bone of the metacarpus, having tubercles, points, &c. in the same manner.

836. The body is long and obliquely triangular, the angle that makes the hollow of the foot, being turned obliquely outward. The rest is proportionably as in the metacarpus.

837. The third bone of the metatarsus is smaller than the second, and the basis of this and of the fourth bone very narrow; and indeed these two bones are very much alike. The third is considerably less than the second, but the fourth is very little less than the third.

838. The basis of the third is deepest, conformably to its articulation with the anterior side of the third Os Cuneiforme. Besides this posterior side, it has lateral surfaces for its articulation with the third and fifth bones of the metatarsus.

839. The basis of the fourth bone is broader and shorter than that of the third, and articulated with one portion of the anterior side of the Os Cuboides. In every thing else it resembles the rest.

840. The fifth bone of the metatarsus has something peculiar. Its basis is transversely broader than it is thick or high, being very oblique, and terminating by a tuberosity and point which lie a great way out of the plane of the basis. The tuberosity is turned outward, and the point quite backward. The principal side is oblique, answerably to that of the second portion of the anterior side of the Os Cuboides.

841. There is likewise an internal lateral surface, articulated with the basis of the fourth bone. The tuberosity and point serve for the insertion of the peronæus medius. The posterior part of the bone is expanded proportionably to the basis, so that this bone is obliquely pyramidal; and the tuberosity

tuberosity reaches to the ground, in the natural situation of a foot which has not been spoiled by high-heeled shoes.

§ 7. *The bones of the toes.*

842. The toes make the third part of the foot, and terminate the whole inferior extremity, and with that the whole body. They are five in number on each foot, called *the great toe, the second, third, fourth, and the little toe.* The figure of them is something like that of the fingers.

843. Each of the toes, except the great one, consists of three phalanges; the great toe has but two, whereas the thumb has three; but then there are five metatarsal bones in the foot, and but four metacarpal bones in the hand. The bases of the phalanges remain for as long a time epiphyses as those of the hand.

844. The great toe is very thick and big, *The great toe.* whereas the other toes are very small in proportion to the fingers.

845. The first phalanx of the great toe is pretty like the second of the thumb, but its basis is more hollow, answerable to the convexity of the first bone of the metatarsus, by which it is supported. Its head is in form of a pulley, as in the thumb, but much broader.

846. The second or last phalanx of the great toe is like the third of the thumb, but bigger and broader, especially at the basis. The tuberosity in the shape of a horse-shoe, which terminates this bone, is more unequal and more flat than in the thumb.

847. The other four toes are very small when compared with the great one. The first phalanges are the longest, but they are shorter and more convex *The other four toes.* an those of the fingers. Their bodies are very narrow, and contracted in the middle. The bases are generally excavated, and the heads made after the same manner as in the fingers.

848. The second phalanges are very short, and almost without shape. Both their bases and heads are formed for articulations by ginglymi, but they are very imperfect. The bodies are of some length in the second and third toes, but they

they are very short in the other two, especially in the little toe, the body of which is broader than it is long.

849. The third phalanges are nearly of the same figure with those of the fingers, but much shorter and thicker in proportion. In the two last toes they are often united with the second phalanges, which is owing perhaps to the continual inaction and compression occasioned by the shoes.

850. The sesamoide bones in general are very small, being denominated from a seed to which they are supposed to bear a resemblance. Several such bones are found in the joints both of the toes and fingers; but as they are for the most part very small, and fixed chiefly to ligaments, it will be more proper to speak of them in the description of the fresh bones.

851. Two of them, however, are big enough to be preserved in skeletons. They resemble a large flat oval pearl, hollowed on one side.

852. They are about the third part of an inch in length, and half as broad as long; and they are connected very near each other, by a small short ligament, to the basis of the first phalanx of the great toe, so as to slide on each side of the middle eminence of the double pulley in the first metatarsal bone, like two small patellæ.

853. Though they are generally fastened, in skeletons, to the first bone of the metatarsus, they nevertheless belong only to the first phalanx of the great toe, as the patella belongs not to the Os Femoris, but to the tibia. I shall have occasion to say something more about them in the history of the fresh bones.

§ 8. *Mechanism and use of all the bones of the lower extremity.*

854. The articulation of the Os Femoris with the Os Ilium, being by enarthrosis, that is, the spherical head of the thigh-bone being lodged in the acetabulum, the thigh is disposed to be moved in all directions. We can carry it forward and backward, nearer the other thigh, or to a greater distance from it; and these four motions may be rendered more or less oblique, and thus the number of them may be multiplied according to the different degrees of obliquity.

855. All

855. All these motions may likewise be combined in such a manner, as that the lower extremity of the bone shall describe a sort of circumference, while the head moves only round a centre.

856. The Os Femoris may also have another kind of motion, called by anatomists, *rotation*, though very improperly. By this motion they understand two reciprocal half-turns, that is, in opposite directions to each other, which the thigh is capable of making round an axis, which they take for the axis of the bone; but it is very evident, if we consider the obliquity of the neck, that this motion is not round the axis of the bone, but round a line drawn from the head, to the middle of the pulley at the lower extremity, when the subject is supposed to be standing.

857. We are likewise to observe, that by this rotation of the Os Femoris, the neck and great trochanter are moved simply backward and forward, whereas when the bone is moved directly forward or backward, the neck moves more or less round its axis, especially if at the same time the bone be held at some distance from the other.

858. All these motions of the Os Femoris are differently limited by the structure of its articulation, and especially by that of the acetabulum; and likewise pretty much by the situation of the head on the superior extremity of the bone. In a word, the depth and obliquity of this articulation render the mechanism thereof very particular, and it is of the greatest consequence to be well acquainted with it in cases of luxations and fractures. The following observations will be sufficient to give a true idea of it.

859. The thigh ought to support firmly the weight of the whole body when we stand or kneel; and that in all the different attitudes or changes of situation, that is, whether the trunk be straight, inclined, or turned, and even with the addition of a considerable load.

860. The thigh is moveable in all directions, but the motion of flexion is the greatest of all, whether we stand or sit; that of adduction is likewise considerable, especially when the thigh is bent. These two motions are more frequent, as well as of a greater extent than the rest; for it is chiefly by them that the body is carried from one place to another;

another; and also put in several ordinary and necessary situations, whether in standing, sitting, or lying.

861. These two general dispositions are founded on the depth and obliquity of the articulation. By the first, the thigh becomes able to support the body in all the attitudes already mentioned, and by the second the principal motions are made easy.

862. The acetabulum or cotyloide cavity is deeper on the upper and back part than on the lower and fore part; and it is at these two places, or in the middle space between them, that the body is sustained, according as it is in an erect or inclined posture. The structure of the head of the Os Femoris is exactly suited to these supporting points in the acetabulum, its cartilaginous convexity being larger on the upper part than any where else.

863. The acetabulum is shallow on the fore and lower parts, not only because these parts are less necessary for supporting the body, but also because a provision is thus made for the obliquity of the articulation, without which the thigh could not without great difficulty have been bent, or carried inwards or over the other thigh. The obliquity of the cotyloide cavity facilitates the motion of adduction, and the obliquity of the head of the Os Femoris facilitates and enlarges the motion of flexion.

864. In the motion of adduction, part of the head of the bone goes out of the cavity, and that in two different ways. When we stand or lie at full length, and in these postures separate the thighs from each other, the head goes out at the lower part of the cavity; but when we sit or lie on our backs, with the thighs raised, and separate the thighs, it goes out on the fore part.

865. The motion, called *rotation*, varies according as the thigh is extended or bent. The rotation of the thigh when extended, brings the head of the Os Femoris either forward or backward. When the head is carried backward, the neck strikes against the posterior edge of the acetabulum, and a large portion of the head goes out at the anterior part of the cavity; but when the head is carried forward, a very small portion of it goes out of the cavity, because of the depth of the edge at the back part, and the neck does not strike against the anterior edge, which is very low. In the rotation of the thigh
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when bent, the head is brought upwards and downward, and goes less out of the cavity above than below.

866. The articulation of the tibia with the Os Femoris is of a very singular nature. In the flexion and extension of the tibia it is a ginglymus, but there is something more in it still, by which the leg becomes capable of having a rotation independent of that of the thigh. This double mechanism depends on the semilunar cartilages, and therefore must be referred to the description of the fresh bones. It will be sufficient in this place to make that motion be conceived, which I term *the rotation of the leg* when bent; because in that case only, it is possible, and we see it evidently, when, sitting and pressing the heel against the ground, we turn the toes alternately outward and inward.

867. We then observe, that the whole leg makes reciprocal half-turns independently of the thigh; and if at the same time we put our hand upon the knee, and then grasp the joint with our fingers, we feel the head of the tibia to move in the same manner, while the extremity of the Os Femoris remains at rest.

868. And if we examine attentively, we shall find, that the centre of this motion is rather in the inner cavity of the head of the tibia, than in the middle space between the two cavities; for we feel distinctly that the external part of the head of the tibia moves backward and forward, while the internal turns almost wholly round its axis.

869. We may therefore distinguish three sorts of motion in this joint, that of flexion and extension, the rotation of the internal part of the head of the tibia upon an axis, and a kind of arthrodial motion of the external part of the same head.

870. I look upon the patella as a piece belonging as really and peculiarly to the tibia, as the olecranon does to the ulna; because it is of the same uses with respect to that bone, as the olecranon is of to the other. They both serve to facilitate the action of the extensor muscles, by placing their direction at a greater distance from the centre of motion of the joint.

871. They both serve to defend the tendons of the muscles from the compressions, contusions, and ruptures which they would otherwise be subject to in great efforts, did they

pass over the sharp edges of the bones; and lastly, they secure these tendons from the like accidents when the joints strike against or press upon any hard body, as when we lean on the elbow, or kneel; or when the elbow or knee receive any external injury from strokes, &c.

872. The difference between the patella and olecranon lies in this, that one is immoveable, making but one piece with the ulna, the other is moveable, being a piece distinct from the tibia. The immobility of the Olecranon strengthens and secures the articulation of the ulna with the Os Humeri, which is designed only for flexion and extension.

873. For the same reason the patella would have been immoveable, had the articulation of the tibia with the Os Femoris been contrived for these two motions alone; and especially because the extensor muscles of the tibia are very often exposed to greater efforts in supporting the weight of almost the whole body, sometimes increased by that of a considerable burden.

874. The rotation of the leg when bent is the sole cause of this difference; because, had the patella been immoveably joined to the tibia, the leg could never have made these half-turns, without either a luxation, or fracture of the patella. The olecranon may therefore be looked upon as an immoveable patella, and the patella as a moveable olecranon.

875. The fibula is articulated by its upper extremity, with the lower surface of the external condyle of the head of the tibia. This is an obscure arthrodia, and suffers the head of the fibula only to slide a little forward and backward; the only design of which small degree of motion seems to be, that the fibula, in which many muscles of the foot are inserted, may have liberty to yield a little in the violent efforts of these muscles, as in running much, jumping, or walking under a heavy burden, as we shall see in the exposition of the muscles.

876. This bone is likewise joined to the tibia by its lower extremity, and makes the outer angle; but this connection is chiefly ligamentary, as shall be shewn in the description of the flesh bones. The upper edge of the cartilaginous surface of this extremity is articulated at the lower part of the lateral depression of the tibia, with a narrow cartilaginous border,

border, which is nothing but the thick edge of the cartilage at the basis of that bone.

877. The extremities of these two bones touch each other likewise a little by their bony portions, near the cartilages. The articulation, resulting from these two sorts of connection, has but a very small extent, and seems to be partly a synarthrosis, partly a diarthrosis; that is, a sort of amphiarthrosis or doubtful articulation, almost without any motion, except what is necessary to make it the centre of motion of the upper extremity of the fibula.

878. The cartilaginous side of the external angle or lower extremity of the fibula completes the cavity, by which the leg is joined to the foot, and contributes more to that than the internal angle.

879. The crookedness frequently observed in the fibula, below the middle or at about two thirds of its length, does not seem to be natural, (because we sometimes meet with this bone perfectly straight), but to be rather owing to the manner of dressing children, this being the place at which they are swaddled very tight.

880. The fibula is not situated directly on the outside of the tibia, but a little more backward; so that having placed the two legs of a skeleton in their natural erect posture, a pretty thick rod might be passed between the two tibiæ and fibulæ without changing the situation of the legs.

881. The foot is articulated with the leg, by the astragalus alone. This articulation is a true angular ginglymus, and confined entirely to the motions of flexion and extension.

882. It is commonly thought that two other motions are likewise performed by means of this articulation, viz. that of turning the toes inward or outward, and that of the lateral flexion of the foot, or the turning the sole of the foot toward either angle. But neither of these motions depend on the articulation of the foot with the leg, as the structure of the parts, and just observations evidently shew.

883. The articulation of the astragalus with the several surfaces of the Os Calcis is a kind of obscure arthrodia, as well as those of the other bones of the tarsus with each other. By these articulations, the foot not being supported, makes the small lateral motions already mentioned; but when the toes are turned outward or inward independently of the ti-

bia, the Os Calcis makes small half-rotations under the astragalus, and obliges the Os Scaphoides to slide in the same direction with it on the anterior side of the astragalus; and this motion of these two bones is communicated to all the rest.

884. It is by the articulation of the Os Scaphoides with the astragalus, that the small lateral flexions of the foot are performed, *viz.* when the sole of one foot is turned toward the other foot, or the contrary way. In this case the Os Scaphoides makes small rotations on the anterior side of the astragalus, while the Os Cuboides slides up and down on the fore-side of the great apophysis of the Os Calcis. The obliquity of the articular surfaces of these two bones is perfectly suitable to such a motion. In these motions the Os Calcis and astragalus are in a manner immoveable; but the other bones are carried along with the Os Scaphoides.

885. The articulation of the Os Scaphoides and Cuboides with the three Ossa Cuneiformia; that of the four last mentioned bones, with those of the metatarsus; and that of the metatarsal bones with each other, allow of an obscure motion, by which we can bend or contract the foot according to its length, and a little according to its breadth likewise.

886. All these motions of the bones of the tarsus and metatarsus are pretty sensible in children; and the loss of them is often owing to the manner of wearing shoes, which loss is most frequent in the small bones of the tarsus and those of the metatarsus. Womens high-heeled shoes change entirely the natural state of these bones, causing in them the same sort of disorder that we observe in the vertebræ of crooked persons. Those who do not wear strait shoes, may preserve these motions to a very advanced age.

887. The articulation of the first phalanges of the toes, with those of the metatarsus, is spheroidal or orbicular, and allows motion in different directions. The articulation of the phalanges with each other is by ginglymus. In the natural state these motions are very free and easy, and they are impaired chiefly by the bad manner of wearing shoes, and it is for the same reason that the phalanges of the little toe often grow together.

888. The articulation of the sesamoide bones is a kind of ginglymus, but the explication thereof belongs to the history of the muscles.

*End of the Description
of the Tarsal Bones.*

SECT.

S E C T. II.

A description of the Fresh Bones.

I. **I**T is not enough to have an exact knowledge of the skeleton, or of the common osteology; we ought likewise to be acquainted with the natural state of the bones when fresh. *Introduction.*

2. The famous Riolan used to demonstrate these two kinds of osteology separately, beginning his courses of anatomy by the skeleton, and concluding them by the natural bony fabric of the body. This last he termed *osteologia nova*, and he has given us an idea of it in a particular treatise placed at the end of his *Enchiridion Anatomicum*. His words are these. "There are," he says, "two kinds of osteology; one of which is to be learned from bones dried and prepared by boiling, &c. the other from the bones of a dead subject, as they are naturally connected with each other. Both these methods are very necessary for the practice of physic, and for the exact knowledge of the human body."

3. "For, by examining dry bones, we can only learn their exterior form, their situation, and the connection which they may have with one another. But when we consider them as joined together in a dead body, we are in a condition to observe many other things about them useful in physick, because their connections with one another by cartilages and ligaments, and by the diversity of articulations, are sometimes very different in dry bones from what we find them when the bones are moist and fresh. There are, for instance, in dry bones, certain cavities which appear to be cotyloide, because they are divested of their cartilages; but in fresh bones they are found to be glenoide, their cavities being filled by cartilages. On the other hand, some cavities appear to be glenoide in the skeleton, which are cotyloide in the body, their cavities being augmented by cartilaginous supercilia."

4. "The exterior form and qualities of bones are much better demonstrated from fresh subjects than from prepared bones, because they lose a great many things in boiling,

“ boiling, such as the cartilaginous borders, the periosteum,
“ the mucilaginous substance found between them, and the
“ marrow contained in their cavities ; all which may be
“ shown in a fresh body, but cannot be shown in a skeleton.

5. “ It is therefore necessary, for the practice of physic,
“ and especially for the cure of fractured or luxated bones,
“ to examine attentively how they are framed, and joined
“ together in the body. I would not, however, be thought
“ to disapprove the custom of preserving dry bones, and of
“ teaching the common osteology. We ought always to
“ begin by this, and afterwards shew the natural disposition
“ of the bones, in the body ; in the manner that I have
“ done in my courses.” These are the express words of the
illustrious Riolan, which I could not help transcribing.

6. This method of making a particular, regular, and complete demonstration of all the bones, newly cleaned from the muscles and other parts that surround them, seems to have been wholly neglected ever since Riolan’s time, till I publicly restored it ; but instead of ending my courses by the fresh bones, I always demonstrate them immediately after the skeleton, because I look upon this as one of the principal foundations of anatomy ; and that it ought naturally to follow the common osteology, as being a necessary introduction to the knowledge of the muscles.

7. In this osteology I shall observe nearly the same order as in the former, beginning by what relates to the fresh bones in general, and from thence going on to the particular history of each bone.

8. The general doctrine of fresh bones takes in their external conformation, internal structure, connection, and uses.

9. In the particular description I shall follow the common division of the skeleton ; but I chuse, for reasons which shall be given hereafter, to begin by the extremities, and from thence to proceed to the trunk and the head.

10. I shall repeat as little as is possible, of what I have said in the description of the skeleton ; but confine myself to those things only in which the differences between dry and fresh bones precisely consist.

A R T. I.

The external conformation of fresh bones.

11. **B**Y the external conformation of fresh bones, I understand, as in the common osteology, all that is visible without breaking them, such as their size, figure, outward parts, and colour.

12. The difference between fresh and dry bones is chiefly owing to the parts that are peculiar to them, and to their natural colour. I say, chiefly, because merely by drying, both their size and figure may be altered; but these alterations are more remarkable in the cartilages than in the bones.

13. Of the external parts of fresh bones, some are common to them with dry bones, such as the regions, eminences, cavities, and inequalities; others are peculiar to them, as being either for the most part wanting in dry bones; or, if they remain, their natural state being changed.

14. The external parts peculiar to fresh bones are principally the cartilages, ligaments, membranes, and mucilaginous glands. On account of all these parts, as well as of the colour, the external conformation of the bones of a fresh subject differs from that of a skeleton, even in the other parts which are common to both.

15. I shall here give a general idea of each of these parts, referring what relates to the colour, to the description of the internal structure.

§ 1. *Cartilages of fresh bones.*

16. A cartilage is a whitish or pearl-coloured substance, which covers the extremities of bones joined together by moveable articulations, increases the volume of some of them after the manner of epiphyses, unites others very closely together, and has no immediate adhesion or connection with others.

17. The substance of cartilages is more tender and less brittle than that of bones; but with age they sometimes grow so hard as to become perfectly bony. They are pliable
and

and elastic, and so capable of restoring themselves after having been compressed or bent to a certain degree; but when bent beyond that degree, they break.

18. All that I have here said about cartilages, is comprehended in the short definition which Carolus Stephanus has given of them in his anatomy. "A cartilage," he says, "is a part of the body, which truly deserves the name of simple or similar. It is harder than all the other parts, but softer than the bones, white, smooth, polished, and pliable or flexible. The cohesion of its parts is different in different cartilages; and no sensible cavity, cell, or pore, appears in any part of its substance, except very small passages for the blood vessels," &c.

19. I here speak only of cartilages that belong to the bones. Those which have no relation to them, are described in other parts of this anatomical exposition. The cartilages which belong to our present subject, differ from each other, in size, figure, situation, and use; and may all be ranked under two general heads; those which are closely united to bones, and those which are not immediately connected with them.

20. The cartilages united to bones are of four kinds, already hinted.

21. Some cover both sides of the moveable articulations, and are very smooth and slippery.

22. Some unite the bones to each other, either so firmly as to allow no sensible motion, as in the symphysis of the *Ossa Pubis*, and still more in that by which the epiphyses are joined to the bones; or in such a manner as to allow of different motions, as in those by which the bodies of the *vertebræ* are connected. The first grow easily hard, the others appear in some measure viscid, and retain their flexibility.

23. Some increase the size and extent of bones. Of these, again, some are articulated with other bones, as the cartilaginous portions of almost all the true ribs, or with other cartilages, as the *septum narium*; others serve only for borders, as those of the basis of the *scapula*, and of the *crista* of the *Os Ilium*, the *supercilia* of cavities, and those of the spinal and transverse processes of the *vertebræ*.

24. Some, in fine, have a singular form, as those of the ears,



ears, and most of those of the nose; in which last, their elasticity appears most sensibly.

25. The cartilages belonging to the second general class, or those not immediately joined to bones, are, for the most part, placed in the moveable joints; and may likewise be subdivided into several kinds.

26. Some lie altogether loose, being joined neither to the articulated bones, nor to the cartilages which cover them, but slide freely between them in different directions; as those which are placed in the articulation of the tibia with the Os Femoris, in that of the lower jaw with the Ossa Temporum; and in that of the clavicle with the sternum. Those between the clavicle and acromium, and between the first and second vertebrae of the neck, are of the same kind.

27. Some are partly joined to other cartilages, and partly slide between the cartilaginous extremities of the articulated bones, as the cartilage at the lower extremity of the radius.

28. We might likewise reckon among the cartilages, though more improperly, several of the small sesamoide bones which remain long cartilaginous, and also the cartilaginous portions of tendons, which do the same office with sesamoide bones.

§ 2. *The ligaments of fresh bones.*

29. A ligament is a white, fibrous, close, compact substance, more flexible than a cartilage, not easily ruptured or torn, and which does not yield, or at least but very little, when pulled.

30. It is made up of very small and very strong fibres, which, by their different texture and disposition, form narrow cords, broad bands, or thin webs; and these serve to bind, contain, limit, and defend the other parts both hard and soft.

31. I am not here to speak of the ligaments peculiar to the soft parts, nor of those which are common to the soft and hard parts; but confine myself wholly to those which belong to bones or cartilages alone. Of these we may establish two general classes: the first, containing those ligaments which are or use only to the bones in which they are inserted; the other, containing those which serve for other parts besides

the bones in which they are fixed, and principally for the muscles. If we have regard to the bones only, these last are improperly termed *ligaments*, as not doing the office of such, and consequently resembling the true ligaments only in texture.

32. Of those ligaments which are fixed in bones or cartilages alone, and are not employed about the other parts, some belong wholly to the articulations or moveable bones, and others have nothing to do with the articulations.

33. The ligaments which belong particularly to the moveable articulations, and may therefore be called *articular ligaments*, are of several kinds.

34. Some are designed only to fix and strengthen the joints, and to secure the bones in their different motions, from parting from each other, as it happens in luxations. These ligaments are like ropes more or less flat, or like bands, sometimes narrow, and sometimes of a considerable breadth; and though some of them are thin, they are all very strong and yield but little. The ligaments of the articulations by ginglymus, and those that tie the bodies of the vertebræ together, are of this kind.

35. Some contain a very fluid mucilaginous liquor commonly called *Synovia*, which continually moistens the articulations. These are not so properly ligaments as ligamentary webs, bound immediately round the articulations, and fixed to the extremities of the articulated bones, and thus forming capsulæ or bags to contain that liquor, and hinder it from running out.

36. These may very well be named *capsular ligaments*. They lie within the former sort, being closely united to their internal surface, and are to be met with in all the moveable joints, as in that of the ulna with the Os Humeri, those of the bones of the carpus with each other, &c. But they are more like membranes than ligaments properly so called.

37. Some perform both the former offices, that of a band to keep the bones together, and of a capsula to hold the mucilage. These surround the orbicular articulations, as that of the Os Humeri with the scapula. of the Os Femoris with the Os Innominatum, &c.

38. All the parts of these ligaments are not of equal thickness, so that they appear to be made up of two kinds of ligaments

gaments inseparably united or glued together; one capsular which surrounds the whole articulation, and several true ligaments extended at different distances over the other, and closely united to it. The name of orbicular ligaments is not general enough, because it does not agree to those of the bones of the tarsus, carpus, &c.

39. I do not think it proper to rank among these, the membranous vagina belonging to the channel or groove in the upper part of the Os Humeri, which shall be afterwards described.

40. Some are hid by the joints themselves and by the capsular ligaments, as that belonging to the head of the Os Femoris, called improperly *ligamentum teres*, and the *crucial ligaments* of the tibia.

41. The ligaments which serve to connect cartilages with bones, might be reckoned another species of articular ligaments; and of these some are proper, as those belonging to the semilunar cartilages of the knee, to the cartilaginous trochlea of the orbit, &c. Others are common, as all those to which the inter-articular cartilages are fastened by their circumferences.

42. The other ligaments of the first class, or those fixed to bones without any relation to the articulations, are of two kinds.

43. Some of them are loose, and serve only to set bounds to the motions of bones; such as those that tie the clavicles to the coracoide apophyses; those that go from one clavicle to the other, and those between the spinal apophyses of the vertebræ.

44. Some of them are tight, and stretched either between the parts of the same bone, as the ligaments between the acromium and coracoide apophysis; or between several bones united together without motion, as those that are fixed by one extremity to the Os Sacrum, and by the other to the Os Ilium.

45. The ligaments of the second general class, or those which being fixed to bones or cartilages are likewise of use to other parts, are of two kinds. Some of them are fixed to bones or cartilages only, and some are likewise fixed to other parts; or other parts are fixed to them.

46. Those of the first kind serve chiefly to inclose, check, limit,

limit, and strengthen the muscles and tendons, and sometimes to change their directions.

47. The annular ligaments are of this kind, and they anciently had their name, not so much from their figure as from their use, which is much the same with that of the rings through which the reins of horses pass; for it is after the same manner that these ligaments bridle the tendons of many muscles, and thus hinder them from starting from their places in violent motions, and, in some circumstances, change their directions.

48. The annular ligaments are either particular and simple, or common, and made up of several single ones, as we shall see in those of the carpus, thumb, &c. Some of them are like vaginae or sheaths, as those on the internal or flat side of the first and second phalanges of the fingers.

49. Some of them are only semiannular, as that of the superciliary notch of the orbit, when there is a ligament there, and that of the notch in the superior costa of the scapula.

50. To these might be referred the ligaments between the acromium and carocoid apophysis of the scapula, and between the Os Sacrum and Os Ischium, which have been already mentioned in the first class.

51. Those of the other kind which come under this second class, comprehend the ligaments fixed to other parts as well as to bones; and these again are of two sorts.

52. Some of them are fixed to one or more bones with different degrees of tension, and serve on each side for the insertion of muscles, supplying in that respect the place of bones.

53. Of this kind are the interosseous ligaments of the forearm and leg, the abductor ligament; the ligament extended on each side of the Os Humeri, from the neck to the condyles, the posterior and lateral ligaments of the neck, and the ligamentary membranes of the posterior foramina of the Os Sacrum.

54. To these may be added the ligaments commonly termed *aponeuroses*; such as those of the temples, scapula, os humeri, ulna, palm of the hand, thigh, leg, sole of the foot, &c. All these shall be described hereafter, and they may in general be termed *aponeurotic ligaments*, *ligamentary aponeuroses*, *ligamentary septa*, *ligamentary vaginae*, &c. But they ought

to be carefully distinguished from the aponeuroses of the muscles and tendons, which shall be mentioned in their proper places. The ligamentum suspensorium of the musculus styloglossus belongs to this place.

55. Other differences of ligaments may be deduced from their consistence, solidity, thickness, situation, and figure, as we shall see hereafter.

56. Some ligaments are almost cartilaginous, as those which surround the head of the radius, and the small head of the ulna, a portion of the orbicular ligament of the head of the Os Femoris, and the annular vagina of the fingers.

57. Some of them have a particular elasticity, by which they are capable of being drawn out by a sufficient force, and of contracting again when left to themselves. This elasticity differs from that of cartilages, which last is hardly perceivable, but by compressing or bending them to a certain degree. It differs likewise from that of the other ligaments, in that it is not only very considerable in living bodies, but remains such after death.

58. Of this kind are the supercilium of the cotyloide cavity, the ligaments which tie the Os Hyoides to the styloide apophyses, the posterior cervical ligament; the ligaments which connect the sharp edges of the spinal processes of the vertebræ to one another, and those seated at the basis of these apophyses next the great canal of the vertebræ, especially in those of the loins.

§ 3. The external membranes of fresh bones.

59. The fresh bones of the human body in their natural state are for the most part covered exteriorly by a membrane, called by the general name of *periosteum*, which is extended over the cartilages and ligaments, as well as over the bones; but where it covers the cartilages, it is termed *perichondrium*, and where it covers the ligaments *peridesmium*. These terms are borrowed from the Greek, but I shall not spend time in clearing up their original significations.

60. The periosteum in general is a fine strong membrane, or membranous expansion, not equally thick in all its parts, more or less transparent, of a very close texture, not easily yielding, extremely sensible, and composed of several particular

cular planes of fibres, differently disposed, and mixed with a great number of small vessels and nervous filaments.

61. This membrane does not immediately surround those portions of bones which are covered by cartilages, nor those in which ligaments and tendons are inserted. Neither does it cover those portions of cartilages which are exposed to frictions, as in the moveable articulations, channels, &c. Lastly, it does not cover those portions of the teeth which lie out of the sockets and gums.

62. The innermost plane of the fibrous texture of the periosteum, or that which immediately adheres to the surface of the bones, is fixed thereto by an infinite number of small fibrous extremities brought from all the planes, and which enter the pores of the bones. These extremities are accompanied by capillary vessels and nervous filaments, which, having run for some space between the different planes of the periosteum, perforate the innermost, at the orifices of the pores of the bones.

63. The periosteum is of different thicknesses; but this difference does not appear near so much on the outer surface as on the inner, which is marked in many places with impressions owing to the sulci, depressions, lines, and inequalities on the surface of the bones.

64. Some anatomists have been of opinion, that this membrane was not only united, but closely braced round the bones, and that therefore it might set bounds to their growth. It is probable they had only examined a few bones in this view; for had they considered those which have concave surfaces, depressions, and inequalities, they would have found only a simple adhesion of the periosteum without any tension. In places where it is only fixed to the bones by the filaments of its innermost plane, the periosteum is easily pulled from the bones; but this separation is more difficult where the fibres of the other planes likewise penetrate the bone, especially when these planes are numerous; and likewise where the insertions of tendons or ligaments mingle with these fibres.

65. The periosteum in general serves to support that admirable texture of an infinity of capillary vessels, by which the bones and all the parts belonging to them are nourished. It likewise supports a great number of nervous filaments, by which sensation is communicated not only to this and to the internal

internal membrane of the bones, but even in some degree to some portions of the bones themselves. Other uses of the periosteum shall be explained hereafter.

§ 4. *The mucilaginous glands of fresh bones.*

65. In all the moveable articulations, especially of those persons who end their lives by sudden or violent deaths, we find a viscid liquor, in some measure resembling a liquid mucilage, or the white of an egg well beat, which is commonly called *synovia*, a name given at first to a disease.

67. This liquor is contained, together with the articulations, in the ligamentary capsulæ, which hinder it from running out. It is furnished chiefly by small bundles of glands more or less flat, contained in the same capsulæ, and known by the name of *mucilaginous glands*, these being the organs through which this mucilage is conveyed from the blood. It may likewise partly transude through the pores of the internal surface of the capsular ligaments, and partly be made up of an unctuous matter squeezed from the fatty substances lying near the glands, by the motion and friction of the articulated bones.

68. These glands are more or less of a red colour, and of a very singular structure, resembling small floating fringes, of different thicknesses, made up of folliculous or vesicular grains, and furnished with a great number of vessels running in very different directions. In some places they appear like distinct grains immoveably fixed. They are proportioned to the bones and joints, and lodged so as to be secured from violent frictions, chiefly near the edges of the capsulæ, or in particular cavities contrived on purpose to receive them.

69. The liquor continually furnished by these glands, mixed with that which sweats through the pores of the capsulæ, and perhaps that which comes from the fatty moleculæ, is diffused between the articulated bones; and its use is, to facilitate their motions, to prevent them from bruising each other, and to keep their cartilages from drying or wearing out.

70. In the particular description, we shall explain the differences of mucilaginous glands, with respect to their conformation, size, number, and situation.

A R T. II.

The internal structure of fresh bones.

71. **I**N order to become acquainted with the internal structure of fresh bones, their substance, internal cavities, marrow, membrana medullaris, and vessels, must be examined. The three last belong to this treatise; the two first have been already described in the treatise of dry bones, which it would be very proper for beginners to revise, that they may comprehend as they ought what is here to be said.

§ 1. *The marrow or medullary membrane of fresh bones.*

72. The greatest part of the bones contain in their large cavities or cells an unctuous fat substance, of a solid consistence in some, and soft in others. It is called by the general name of *marrow*, especially that which lies in the large cavities of the long bones. That which is dispersed in the small cellulous cavities, is likewise called *the medullary juice*.

73. The marrow of the great hollow bones is a mass, composed of an infinity of fine vesicles or membranous cells, joined together, and communicating with each other, furnished with blood-vessels and nerves, and filled with a fine sweet oily matter.

74. All these cells or membranous vesicles are surrounded by a very fine membrane, which, like an internal periosteum, sticks close to the inner surface of the bone, by means of an infinite number of capillary vessels, and of several other kinds of very small filaments. The reticular substance of the bones runs through this medullary mass, and as it were interlards it, and by this means sustains it in the middle of the great cavities.

75. The marrow of the cellulous or cavernous substance of bones is divided by small bony septa or plates, and by the filaments of the reticular substance of bones, into a vast number of vesicles or membranous cells, which line the bony cells, and communicate with each other. This cellular mat-

row in the cavernous texture of bones differs from that in the great cavities, both in colour and consistence. It is liquid, and almost quite of a red colour; whereas the other is much more solid, and is often of a red colour only on its surface.

76. This difference is owing to the blood-vessels which run through each membranous cell, whereas the marrow in the great cavities seems to be furnished with them in the common membrane only. Many of these medullary cells are likewise divided by the bony filaments of the cavernous substance, and these small filaments, as well as those of the reticular texture, are covered by portions of the medullary membrane, as by a periosteum.

77. The medullary membranes may be separated from the liquor which they contain, by steeping the whole mass in very hot water, and afterwards compressing it by gentle degrees. But it is to both these substances taken together that anatomists give the name of *marrow*, not to either of them taken singly. The medullary membrane is very sensible, but not the juice; which is necessary to be observed to understand what is meant by the sensibility of the marrow. It is true, however, that, in the materia medica, this name is given to the oily substance alone.

78. The marrow by its liquid and unctuous part renders the bones in some measure pliable, and less brittle, by continually running through the substance of them in small degrees. This continues to old age, and then the bones being deprived of the marrow, become very brittle.

§ 2. *The vessels of fresh bones.*

79. All the parts of fresh bones have blood-vessels, which may be reduced to three classes. Some go to the external parts of bones, to the ligaments, cartilages, mucilaginous glands, and periosteum. Others penetrate the substance of the bone, and the third kind goes all the way to the internal cavities, and is distributed to the marrow.

80. The vessels of the first class, that is, those spread on the external parts of bones, are ramifications of those which go to the neighbouring muscles, and other parts which lie near the bones. The greatest number of them go to the periosteum,

riosteum; and run in between its different planes, being divided into an infinite number of capillary ramifications, disposed in a reticular manner by their frequent communications. I shall not here take upon me to determine whether this membrane has any particular elastic force by which it can increase that of the blood-vessels.

81. The vessels of the second class, or those of the substance of bones, are productions or continuations of those of the periosteum, which enter the pores of the bones like very fine filaments, and run longitudinally between the bony fibres. The existence of these small vessels becomes very certain from fractures, especially in young people.

82. The arteries and veins do not seem here to accompany each other as in the other parts of the body, but to run in opposite directions till they meet. This conjecture is founded on the different obliquity of certain holes. It must not however be imagined that all the arteries enter at one end of the long bones, and that the veins go out at the other; the reunion of fractured bones is sufficient to destroy this opinion.

83. The vessels go to the inner substance of the bones, not only through the external pores, but also through those of all the inner cavities, both great and small, being detached from the medullary membrane in the same manner, as from the periosteum.

84. The vessels of the third class come likewise from the periosteum. They appear to be destined chiefly for the marrow and medullary juice, and are spread in great numbers over the membranes of each. They enter the cavities of the hollow bones through the oblique ducts in their solid substance, and into the cells by the other small openings. They spread themselves in all directions, not only on the membranes of the marrow and medullary juice, but likewise through the substance of the bones in their passage to the inner cavities.

85. The arteries and veins of this class often accompany each other as they pass through the bones, and sometimes each passes through a separate duct.

86. The vessels of the first class chiefly no nourish the external parts of the bones, and to furnish the mucilaginous glands with the liquor secreted by them. Those of the second

cond class furnish the nutritious juice of the inner substance of the bones. The uses of those of the third class have been already mentioned.

§ 3. *The colour of fresh bones.*

87. The natural colour of the fresh bones of an adult human body is whitish, with a small mixture of a pale red. This red colour is more considerable in children, but decreases by degrees as they grow up, and is quite lost in old age. It is most remarkable in the surface of spongy bones, and more towards the extremities of the hollow bones, than in the middle; and lastly, it is more or less perceivable in proportion to the different thickness of the bony laminae which cover the cellular substance.

88. This red colour is owing to the blood-vessels of the bones, which being in infancy larger and less surrounded by the bony juices, than in an advanced age, make the colour of the blood to appear in some degrees through the substance of the bones; whereas in old age these vessels being compressed by the increased and condensed bony juices, contain but very little blood, and are not at all transparent. The particular differences of the red colour, not only in the bones of the same subject, but also in the different parts of the same bone, depends on the medullary juice which is much redder than the marrow in the great cavities, and likewise partly on the thickness of the bony substance by which that juice is covered.

A R T. III.

The fresh bones in particular.

89. **W**HAT has been already said about the mucilaginous glands and blood-vessels of fresh bones in general, may be easily applied to the greatest part of them in particular. But the cartilages and ligaments are different in each bone, and therefore require to be particularly described. And as these parts are more diversified, largest, and more distinct in the extremities of the body than in the trunk; I

think it proper to begin by these, that they may afterwards serve for examples of what is to be said about the rest.

90. Moreover, as it is only in this osteology that a true idea can be given of the articulations in their natural state, I shall be obliged to begin by the *Ossa Innominata*, because of the acetabulum with which the *Os Femoris* is connected, and because of several other particulars necessary to be known in order to comprehend the mechanism of that articulation.

91. Though the *Ossa Innominata* belong to the trunk in the ordinary division of the skeleton, they may however be considered with respect to the lower extremities, much in the same manner as the scapula, with respect to the upper extremities. For this reason likewise I must say something of the *Os Sacrum* to which these bones are joined, and likewise of the last vertebra of the loins.

92. This particular osteology is attended with one difficulty which does not fall in our way in the description of the skeleton. We make a complete description of each dry bone, which we cannot do of each fresh bone, because of the connection it has with the neighbouring bones, some parts of which must consequently be mentioned, especially those in which ligaments are inserted.

93. To remove this difficulty, without breaking in upon that order, by observing which these descriptions will be easy and intelligible, I shall examine particularly the ligaments of each bone in the following manner: I shall first give the complete history of the ligaments by which each bone is connected to those immediately above it, and then barely mention those that tie it to those below.

94. I shall not explain in what manner or for what purposes the bone which I have described, is joined to that which I am to describe next in order, till the description of this last is likewise finished. Thus, for instance, I shall not give the history of the connection of the *Os Innominatum* with the *Os Femoris*, till I have explained all the parts of the thigh-bone concerned in that articulation; nor the history of the connection of the *Os Femoris* with the tibia, till the latter has been described; and so of the rest.

95. This osteology presupposes the exact knowledge of the foregoing, that is, of all the particulars relating to the skeleton,

leton, of which I shall here mention only as much as is necessary to enable us to apply to the skeleton what has been already said in general about fresh bones.

§ 1. *The fresh bones of the lower extremities.*

96. The cartilages of the *Ossa Innominata* are not so numerous, as one might imagine on examining the skeleton only. We are apt to think we see the dried remains of cartilages on the crista of the *Os Ilium*, on the tuberosity of the *Os Ischium*, and on the grooves and notches which give passage to the tendons of muscles. But none of these incrustations are true cartilages, being for the most part tendinous, aponeurotic, or ligamentary, which being dried, look more like cartilages than the true cartilages themselves. *Cartilages of the Ossa Innominata.*

97. The crust which covers the crista of the *Os Ilium* is chiefly tendinous, and a small part of it aponeurotic in adult bodies, but in children and very aged persons it appears cartilaginous. In children, the parts which are not completely ossified, are easily taken for true cartilages; and in old age the tendons are often hardened to so great a degree, as to have the very same appearance. The substance which covers the tuberosity of the *Ischium* is almost entirely tendinous, and that which lines the grooves and notches of the tendons is chiefly ligamentary.

98. The true cartilages of the *Ossa Innominata* in adult subjects, are five in number, three common, and two proper.

99. The first and principal common cartilage is that which makes the symphysis of the *Ossa Pubis*. It reaches from the interval between the spines of these two bones, all the way to the angle formed by the two rami, where they begin to separate. It is something thicker or broader at its upper part, than for a considerable space lower down, but the inferior part is by much the broadest. It fills the angle already mentioned, and forms a kind of arch, which is more considerable in women than in men.

100. The two other common cartilages join the *Ossa Ilium* to the *Os Sacrum*, but are thinner than that of the *Ossa Pubis*.

101. The

101. The proper cartilages are those that line the cotyloide cavities. Concerning these we have already observed in the description of the skeleton, that in the edge of each, there is a notch or opening between the anterior and inferior parts; and that in the cavity itself, there is a broad, unequal shallow depression, reaching from the notch, beyond the middle of the cavity. All the rest of the surface of the acetabulum is covered with a very white, shining, smooth cartilage, which terminates precisely at the edge of the cavity.

102. The circumference of the acetabulum has, besides, a border of a particular kind, the substance of which is neither wholly cartilaginous nor wholly ligamentary; but I chuse to place it among the ligaments.

Ligaments of the Ossa Innominata. 103. The ligaments of the Ossa Innominata are of two kinds, common and proper. The common ligaments are those which go between these and the neighbouring bones, of which there is a considerable number, viz.

104. One superior ligament inserted by one end in the internal labium of the posterior part of the crista of the Os Ilium, about an inch above the angle of that crista. It is about an inch in breadth, and is fastened by its other extremity in the whole inferior edge of the transverse apophysis of the last vertebra of the loins.

105. One inferior and anterior, fixed by one end in the inner side of the angle of the crista of the Os Ilium, and by the other in the superior and anterior part of the first false transverse apophysis of the Os Sacrum. In this ligament there are transverse openings which make it appear more or less complex.

106. Several inferior and posterior, fixed by one end along the internal labium of the tuberosity of the crista of the Os Ilium, and by the other in the first three false transverse apophyses, and from thence extending laterally over the marks of the false oblique apophyses of the Os Sacrum.

107. To these must be added the ligaments by which the Os Femoris is joined to the Os Innominatum, which shall be described among the other ligaments of the thigh.

108. The principal proper ligaments are four in number,

two called *sacro-sciatic*, one broad and external, the other small and internal, one obturator and one inguinal.

109. The broad sacro-sciatic or external sciatic ligament is slightly fastened to the inside of the tuberosity of the crista of the Os Ilium, covers exteriorly the two posterior spines of that bone, and continues to be inserted along the anterior and exterior edges of the false transverse apophyses of the Os Sacrum.

110. From thence this ligament diminishing in breadth, descends obliquely towards the tuberosity of the Ischium, and is inserted immediately below the sinus which lies between that tuberosity and the sciatic spine. This insertion is afterwards continued over the whole internal labium of the inferior portion of the Os Ischium, and of the ramus of that bone, and the inferior portion of the ramus of the neighbouring Os Pubis.

111. Through all this latter course of its insertion, that is, after its arrival at the tuberosity of the Ischium, it produces a kind of ligamentary falx, one edge of which is fixed to the bones, the other lies loose; and by this situation of the falx, it forms, together with the bones, a kind of deep channel or groove.

112. The same sacro-sciatic or internal sciatic ligament adheres closely to the inside of the posterior portion of the former. It is fixed anteriorly to the edge of the inferior part of the fourth false transverse apophysis of the Os Sacrum, and from thence, all the way to the upper part of the Os Coccygis.

113. From this insertion, it runs up a little obliquely to the spine of the Ischium, in the sharp point and upper part of which it is fixed. During this course, it crosses the broad ligament, being closely united to the inside thereof, and loses but very little of its breadth.

114. By these two ligaments two distinct openings are formed, a large one, with the superior sciatic sinus, and a small one with the inferior sciatic notch.

115. The obturator ligament fills up all the great foramen ovale, except the oblique notch at its upper part. It is fastened precisely to the edge of the circumference of that hole, from the anterior part of the oblique notch, all the way to the symphysis between the Os Pubis and the Os Ischium.

116. From

116. From thence to the posterior part of the inferior notch, it is fixed to the internal labium of the edge of the circumference, forming a kind of small channel with the external labium; and afterwards it is fixed to the common edge of the foramen ovale and cotyloide notch or opening.

117. By this disposition, an opening is left between this ligament and the superior oblique notch; and immediately below this common opening, there are two small perforations in the ligament alone.

118. On the inside of the upper and anterior part of the Os Pubis, there is a transverse ligament, resembling the shape of a pent-house; fixed by its upper part to the Os Pubis, from the oblique notch of the foramen ovale, all the way to the lower part of the symphysis, at a small distance from the circumference of the last mentioned hole.

119. This transverse ligament is about half an inch in breadth in an adult body; and posteriorly below the superior oblique notch of the foramen ovale, it joins the obturator ligament, by means of a particular fold; and by parting from it afterwards, a kind of deep narrow groove is formed between them, the transverse ligament being at this place supported by ligamentary fræna of different sizes.

120. The inguinal ligament, called from the discoverer *ligamentum Fallopii*, is an aponeurotic or ligamentary band, fastened by one end to the anterior and superior spine of the Os Ilium, and by the other, to the spine of the Os Pubis. The middle portion of it is very narrow, but it expands considerably toward both extremities. It is closely joined to the muscles of the abdomen, and to the aponeurotic fascia of the thigh. It seems to be often wanting, as shall be observed in the description of these muscles.

121. Besides these ligaments peculiar to each Os Innominatum, there is another small flat and very strong ligament, which runs transversely between the two angles of the cotyloide notch, and may be termed *the proper or transverse ligament* thereof.

122. The elastic border of the cotyloide cavity may likewise be reckoned among the ligaments. It is a sort of additional piece strongly united to the edge of that cavity, but easily yields both ways to any pressure. It may be stretched out by pulling, and recovers and contracts again when that force

force is removed. It is of a very singular texture, being composed of elastic fibres, interwoven together through its whole circumference, and which, in several places, are by degrees inclined toward the bony edge of the cavity. It makes an entire circle, and where it passes over the notch, the transverse ligament before mentioned serves to support it, as the bony edge of the cavity does through all the rest of its circumference.

123. Though I have referred the description of the two ligaments by which the Os Femoris is connected to the Os Innominatum to another place, their insertions in the last named bone must nevertheless be mentioned here. One of these ligaments surrounds the whole articulation, the other is contained therein. The first is called *the orbicular ligament*, the other very improperly *the round ligament*.

124. The orbicular ligament is very strong, and unequally thick. It surrounds the whole convex circumference of the supraciliary of the cotyloide cavity, to which it is strongly fixed for the breadth of near a quarter of an inch, from the sharp edge outward, and from thence seems to send off a ligamentary aponeurosis, which shall be explained in the history of the muscles.

125. Its insertion at the sharp edge of the cotyloide cavity, joins that of the elastic border; the rest of the ligament is distinct from the border, and only touches it quite round; and where it passes over the notch, it is fixed in the transverse ligament.

126. The ligament which lies in the joint is not round, as its common name would make us believe. It is a flat cord, broad at one end, and narrow at the other, and therefore in some measure of a triangular shape. By its narrow end, it is inserted at the two angles of the notch of the cotyloide cavity; and by the other in the Os Femoris, in the manner hereafter to be described. This broad end may be reckoned the basis of the ligament; and from thence arise some distinct ligamentary filaments, which are inserted, at different distances, in the circumference of the rough impression of the cotyloide cavity.

127. There is nothing in the periosteum of this bone different from what has been said above, except what

Membranes, mucilaginous glands, and marrow of the Os Innominatum.

relates to the insertion of several muscles; but that cannot be explained till these muscles are described.

128. The rough unequal depression at the bottom of the cotyloide cavity is filled by a broad flat mucilaginous gland, bordered with a fatty substance, and covered by a fine membrane, through which a mucilaginous liquor passes, to moisten the joint, and facilitate its motions. This membrane rises above the gland, and gives a sort of covering or coat to the ligament contained in the joint. The blood vessels of this gland pass between the bottom of the cotyloide notch, and the transverse ligament thereof.

129. As these bones have no internal cavity, and their substance being cellulous or cavernous, they contain no medullary mass. The small cells of their cavernous substance contain a medullary juice, which distils incessantly through the membrane with which they all are lined.

130. The blood-vessels pass chiefly through the small holes in both convex and concave surfaces of these bones, and ramifying upon the bony cells, they end in a great number of small capillary tubes, which make the medullary juice appear red.

131. No part of the Os Femoris is covered with cartilage, except the uniform convexity of its head, and the articular portion of the lower extremity. The trochanters have no true cartilage; what looks like it, being only the remains of tendinous insertions, as has been already observed of the crista of the Os Ilium. The cartilaginous substance, which, to a certain age, unites the epiphyses to the body of the bone, does not belong to this place, because it is only found in the time of youth, and in adults is converted into bone.

132. The cartilaginous matter by which the head of the Os Femoris is cemented, deserves, however, to be observed, because that epiphysis has been separated by violent falls.

133. The convexity of the head of the Os Femoris all the way to its symphysis with the neck, is covered by a very smooth shining cartilage. We have already remarked in describing the dry bones, that a little below the middle of this convexity, and something toward the back part, there is a depression

*Cartilages of the
Os Femoris.*

depression in the shape of a crescent, the cartilage being here interrupted by the insertion of the internal articular ligament of the head of the Os Femoris.

134. The cartilage which covers the lower extremity of this bone, is exactly fitted to the semi-oval convexity of the inferior surface of each condyle, and to the pulley formed by their union.

135. In the posterior part of the lateral tuberosity of each condyle, there is another kind of cartilaginous surface, which was spoken to in the history of the tibia.

136. The Os Femoris is connected by its upper extremity to the Os Innominatum, and by the lower to the bones of the leg, by means of several ligaments. *Ligaments of the Os Femoris,* The ligaments of the upper extremity are two in number, one which surrounds the whole articulation thereof with the cotyloide cavity, and one contained in the articulation. The first is termed *the orbicular ligament of the head of the Os Femoris*; the other, *the internal ligament*. To these we may, though very improperly, add a third, which is of the nature of a capsular ligament, as we shall see hereafter.

137. The orbicular ligament is the most considerable, largest, and strongest of all the articular ligaments of the human body. It is fixed quite round the border of the cotyloide cavity in the manner already said; and from thence largely surrounds the whole head and superior portion of the neck of the Os Femoris, and is closely inserted in the lower portion of the neck, that is, between its basis and middle narrow part.

138. This ligament is made up of several sorts of fibres, the chief of which are longitudinal and oblique, and it is much thicker and stronger in some parts than in others. It is very thick between the anterior inferior spine of the Os Ilium all the way to the small anterior tuberosity, which unites, as it were, the basis of the great trochanter with the basis of the neck.

139. It is likewise very thick between the same spine, and the middle part of the oblique rough line observable between the tuberosity and the little trochanter; and here likewise it is strengthened by a bundle of fibres connected to the pas-

sage of the tendon of the iliac muscle, and to the interior portion of the oblique rough line. The disposition of the ligamentary fibres of which these two thick portions are composed, form a sort of triangle with the oblique rough line which terminates the basis of the neck.

140. At the posterior and upper part of this ligament, there is another thick portion formed by oblique fibres, one end of which is fixed between the inferior edge of the cotyloide cavity, and the passage of the tendon of the external obturator muscle; the other, to the upper part of the small tuberosity of the great trochanter, already mentioned.

141. The posterior and lower part of it is thinner and shorter than the rest; but even this is strengthened by a band of pretty strong fibres, which, from the whole crista of the Os Pubis, runs down obliquely near the foreside of the cotyloide notch, and is fixed in the upper part of the basis of the neck of the Os Femoris, immediately above the small anterior tuberosity of the great trochanter.

142. The other ligament of the head of the Os Femoris, which I call *internal*, resembles a flat cord, being composed of a bundle of fibres closely interwoven. One end of it is in a manner divided into two flat bands, inserted one at each corner of the cotyloide notch in the manner already explained. It might likewise be called *the interarticular ligament of the head of the Os Femoris*.

143. From this insertion, it runs obliquely backward and a little upward between the cotyloide gland, and the cartilaginous convexity of the head of the Os Femoris, and ends in the upper part of the small semilunar fossula, which may be reckoned the pole of that convexity. This insertion is oblique, a little rounded on the upper part, and flat on the lower, and in some subjects there is a sort of depression in the head of the bone for the passage of the ligament.

144. The ligaments of the lower extremity of the Os Femoris, by which this bone is connected with those of the leg, are six in number, one posterior, two lateral, two middle or crucial, and one capsular.

145. The crucial ligaments lie within the joint, and are fixed by one end to the back part of the notch or opening which parts the two condyles. They are surrounded by the capsular

capsular ligament, but all the rest lie on the outside thereof, being closely joined to it.

146. Of the two lateral ligaments, one is internal and broad, being fixed to the tuberosity of the internal condyle; the other is external and narrow, fixed to the tuberosity of the external condyle.

147. The posterior ligament is broad and thin, being fixed a little above the convexity of the external condyle, from whence it descends obliquely, behind the great notch and internal condyle.

148. The capsular ligament glued, as it were, to the three former, as has been said, is fixed quite round the inferior extremity of the Os Femoris, at a small distance above the anterior, lateral, and posterior parts of the cartilage, and above the posterior part of the great notch, and from the cartilage and notch, through the small space upward already mentioned, it covers the bone; and afterwards is inverted downward to form the capsula for the mucilaginous liquor of the joint. The rest of the description of all these ligaments must be referred to that of the bones of the leg.

149. The marrow of the Os Femoris lies in a large mass in the middle cavity of the bone, and in small distinct clusters in the cells of each extremity.

*Marrow of the
Os Femoris.*

The first is penetrated at different distances by the bony filaments or ramifications of the reticular texture, and thereby sustained in violent motions and shocks, as in leaping, running, &c.

150. The tibia has four or five proper cartilages, and two additional ones.

*Cartilages of the
bones of the leg.*

151. The two proper cartilages which cover the two superior surfaces of the head of the tibia, are the thickest. They are both gently hollow; but the internal, or that next the other tibia, is more depressed in the middle than the other. The back part of the external is insensibly depressed, and thereby a sort of convexity is formed. Anteriorly they join each other, posteriorly they are parted by a shallow notch; in the middle, they are separated by the articular tuberosity of the head of the tibia, which is likewise partly covered by them on each side.

152. The third proper cartilage covers the small surface which lies on the lower part of the external condyle.

153. The fourth covers the lower surface of the basis of the tibia, being continued over the outside of the inner angle. There are likewise superficial cartilaginous incrustations on the back part of this basis behind the inner angle, and likewise on the backside of the outer angle, all for the passage of tendons.

154. The additional cartilages of the tibia are two in number, called *semilunar* from their figure, and *intermediate* or *interarticular* from their situation.

155. Each of these cartilages is in the shape of a crescent or Roman C. Their convexity or greatest curvature is very thick, their concavity or smallest curvature very thin, something like the edge of a sickle. They lie on the two upper surfaces of the head of the tibia; their thickest part or convexity answering to the edges of the head, and their thin sharp edges, to the middle of each surface, their extremities or cornua being turned toward each other.

156. Each cartilage is broad enough to cover about two thirds of the surface of the tibia, on which it lies, leaving one third bare in the middle. Their under sides are flat; the upper sides hollow, and together with the middle portions of the surfaces of the head of the tibia, form cavities proportionable to the convexity of the condyles of the Os Femoris.

157. The fibula has two cartilages, one lying on the upper extremity of that bone, for its articulation with the small cartilaginous surface in the head of the tibia. The other cartilage covers the inside of the inferior extremity, or of the outer angle, near the point of which posteriorly there is a superficial cartilaginous incrustation for the passage of the tendons of the musculi peronæi. The cartilage at the upper extremity of the fibula seems to be thicker than that at the lower extremity.

158. The patella which belongs properly to the tibia and not to the Os Femoris, has a pretty thick cartilage on its posterior or articular side, divided by a superficial longitudinal rising into two parts proportioned to the two portions of the pulley of the Os Femoris, as has been observed in the description of the dry bones.

159. I have already observed, that the tibia is connected with

with the Os Femoris by several ligaments, two lateral, one posterior, two middle, and one capsular, and I have shewn in what manner they are fixed in the lower extremity of the Os Femoris. Their insertions in the bones of the leg are as follow.

Ligaments of the bones of the leg.

160. The innermost and broadest of the two lateral ligaments is fixed pretty low down, on the inner side of the superior part of the tibia, between the beginning of the crista or anterior angle of that bone, and the internal angle which is turned toward the other tibia. It is likewise joined to the edge of the internal femilunar or interarticular cartilage.

161. The external lateral ligament, which is narrower and thicker than the former, is fixed partly in the tibia immediately above the fibula, and partly in the upper extremity of the fibula, and is joined likewise to the edge of the external femilunar cartilage. Both these ligaments lie a little behind the middle of the articulation.

162. The posterior ligament is fixed by several expansions in the posterior part of the head of the tibia.

163. One of the crucial ligaments is fixed by one end to the internal superficial impression in the notch of the Os Femoris, and by the other to the notch in the head of the tibia, behind the cartilaginous tubercle which lies between the two superior surfaces. The other crucial ligament is fixed by one end to the external impression in the notch of the Os Femoris, and by the other between the anterior portions of the surfaces just mentioned, before the cartilaginous tubercle.

164. These two ligaments are composed of several series of fibres. The first, which is internal in respect of the Os Femoris, and posterior in respect of the tibia, is broader and stronger than the other, which is external in respect of the Os Femoris, and anterior in respect of the tibia.

165. The femilunar cartilages have likewise particular ligaments, besides their connections with the lateral ligaments of the tibia. Their cornua do in some measure degenerate into short strong ligaments, by which they are fastened to the cartilaginous tubercle between the two superior surfaces of the tibia, and likewise communicate, by some portions, with the crucial ligaments.

166. They have likewise a common ligament, which like
an

an arch runs transversely between the anterior convexity of the one to that of the other.

167. These cartilages therefore have three sorts of connections. They are fastened to the tibia by the ligaments of the cornua; to each other by the transverse ligament; and to the Os Femoris by their communications with the crucial ligaments, and by their adhesions to the lateral and capsular ligaments.

168. The patella is fastened to the tuberosity or spine of the tibia by a broad and very strong ligament which runs down directly from the apex of the patella, and is oftentimes further strengthened by some fibres of a considerable tendon inserted in the upper part of that bone.

169. It has likewise small lateral ligaments fixed in the lower part of its edge on each side, which parting gradually from the great ligament as they run down, are inserted anteriorly and a little laterally in the edge of the head of the tibia.

170. The capsular ligament of this joint, of which I described one part in speaking of the lower extremity of the Os Femoris, is fixed round the edge of the head of the tibia, and in the edge of the patella, so that the patella itself forms a portion of the mucilaginous capsula of the joint of the knee.

171. The crucial ligaments, and those of the femilunar cartilages are included within this capsula; but the lateral and posterior ligaments and those of the patella lie without it, being closely joined to its outer surface.

172. This capsula is likewise joined to a considerable portion of the circumference of the femilunar cartilages; and it is also strengthened at different distances, by several distinct series of ligamentary fibres, more or less thick. The inside of it is smooth and shining, and it is very thin where it is not covered by tendons, as shall be observed hereafter. It not only contains and surrounds the ligaments already named, but likewise furnishes them with a very fine vagina

173. There is likewise a very thin ligament fixed by one end to the lower part of the cartilaginous side of the patella, and by the other to the anterior part of the great notch between the condyles of the Os Femoris, the use of which seems

seems to be to hinder the articular fat from being compressed in the motions of the knee

174. The fibula is joined to the tibia by nine ligaments, four at each end, and one in the middle, called *the interosseous ligament*.

175. The ligaments at the upper extremity of the fibula are short, very strong, more or less oblique and compound. Two of them are anterior, two posterior, and they lie on each other; the superior ligaments surrounding the articulation more closely than the inferior, which leave a small void space, and are weaker than the former. They are all glued to the capsular ligament which runs in between them and the articulation, and they are inserted round the edges of the cartilaginous surfaces in each bone.

176. The ligaments of the lower extremity of the fibula, which runs below the tibia, and forms the outer angle, are much stronger, thicker, more complex, broader, longer, and more oblique than those of the superior extremity; and are disposed much after the same manner, that is, two before and two behind.

177. They are fixed to the anterior and posterior edge of the lateral depression at the inferior extremity of the tibia, and from thence they run down on the lower end of the fibula. The two inferior ligaments are longest, and they are fixed anteriorly and posteriorly at the lower end of the outer angle. The two superior are fixed more closely and nearer each other, but still there is a small space between them filled with fat.

178. As the two bones touch each other only by the upper part of the cartilaginous surface of the outer angle, and the small cartilaginous border in the lower edge of the depression of the tibia, the middle space between them is filled by a sort of capsular ligament, which lines each side of the bones, and is continued down to the true articulation of the external angle, with the inferior edge of the basis of the tibia.

179. The middle or interosseous ligament of the two bones of the leg, so called, because it fills up all the space left between them, being stretched from one to the other, is fixed along the posterior external angle of the tibia, and the neighbouring angle of the fibula.

180. It is made up chiefly of two planes of very oblique ligamentary fibres, which cross each other, and at different intervals, seem to be multiplied. It is perforated both above and below, and sometimes in several places besides; for the passage of the blood-vessels and nerves.

181. It is not a ligament designed to tie these bones together, but rather a ligamentary septum for the insertion of muscles, in which respect it supplies the place of bones, and seems partly to be a continuation of the periosteum of the tibia and fibula.

182. At the lower part of each ankle there are commonly three strong ligaments for the connection of the bones of the tarsus with those of the leg, one that runs forward, one that runs backward, and one that runs more or less directly downward; all of them being fixed in the places hereafter to be mentioned.

183. There are some other ligamentary expansions belonging to the bones of the leg; but as they do not serve so much for the connection of the bones, as to support the muscles, the description of them, as well as of the annular ligaments, will more naturally come in, in the treatise of the muscles.

184. The marrow of these bones lies in large masses in the great cavities, and in distinct molculæ in the spongy parts, as has been already observed in general.

Marrow and mucilaginous glands of the bones of the leg.

185. The mucilaginous glands lie in the small spaces, depressions, and superficial notches near the edges of the cartilages of each joint. They are covered by the capsular ligaments, and more or less mixed with a fatty substance.

186. The glands of the knee, which lie near the edges of the patella, are the most considerable, being disposed in form of fringes, and supported by a great quantity of fatty matter, which makes in some measure one mass with them.

187. This common mass is contained within the capsular ligament, and on the side of the joint is covered by a very fine membrane, which likewise lines the inner surface of the ligament. The glandulous substance is easily distinguished from the fat, by the reddish colour of the capillary vessels which surround the glands.

188. The superior portion of this mass is as it were suspended by the small ligament, fixed in the anterior part of the

the great common notch of the condyles of the Os Femoris, and which from thence runs to the upper part of the patella, as has been already observed in the description of the ligaments.

189. There are other mucilaginous glands both above and below the edges of the semilunar cartilages.

190. And likewise in the ham, some whereof serve for the joint, the rest, for the crucial ligaments. These last lie in folds formed by the internal membrane of the capsular ligament, which give particular coverings to the crucial ligaments, and to the other bundles of ligamentary fibres near them.

191. The astragalus is covered by three cartilages. The first covers the three surfaces, which make the convex part and sides of the pulley; the second, the concave surface of its inferior part; and the third, the convex surface of its anterior part, being continued over the inferior part, so far as to form three other small surfaces, one of which is not articular in a strict sense.

*Cartilages of
the bones of
the foot.*

192. The first of these cartilages is for the articulation of this bone with the tibia and fibula; the second, for the Os Calcis; and the third, for the Os Scaphoides. Two of the inferior surfaces formed by the continuation of the third cartilage, are for the articulation of this bone with the Os Calcis; the third contributes to the formation of a channel for the passage of a tendon.

193. The Os Calcis has four cartilages, of which three are superior, one large and two small for its triple articulation with the astragalus; the fourth is anterior, for the Os Cuboides. To these must be added a small thin cartilage, of a kind of ligamentary substance under the tubercle on the outside of this bone.

194. The Os Scaphoides has two cartilages, one posterior for its articulation with the astragalus; and one anterior divided into three parts for the three Os Cuneiformia,

195. The Os Cuboides has two remarkable cartilages, one posterior for its articulation with the Os Calcis, and one anterior lying in two planes for its articulation with the two last metatarsal bones. It has likewise a cartilage on the inside for the Os Cuneiforme which is next to it, and one on the lower

side, covering a part of the oblique eminence situated there.

196. The three *Ossa Cuneiformia* have each of them a posterior cartilage for their articulation with the *Os Scaphoides*, and one interior for the three first metatarsal bones; they have likewise small cartilaginous surfaces on their lateral sides, for their articulations with each other; and besides, the first and third bones are joined thereby to the lateral parts of the basis of the second metatarsal bone, and the third, to the *Os Cuboides*.

197. The bases and heads of the metatarsal bones are covered with cartilages.

198. The phalanges have cartilages in the same manner at their bases and heads, except at the heads or extremities of the last.

199. The sesamoide bones are covered with cartilages on that side by which they slide on other bones.

200. We ought to beware of confounding the remains of tendons, ligaments, and aponeuroses with the true cartilages; as for instance, at the posterior part of the *Os Calcis*. I gave the same caution when I spoke of the cartilages in general.

201. The foot being made up of many bones, must, besides those ligaments by which it is tied to the bones of the leg, have several others to connect not only the three parts of which it is composed, but also the particular bones belonging to each part.

202. I have already mentioned the insertions of three ligaments in each angle, one interior, one middle, and one posterior, for the articulation of the angles with the foot.

203. The ligaments of the inner angle are all fixed in the inside of the astragalus. The most anterior is pretty broad, and sometimes seems to be joined in one with the middle ligament. It often consists of several distinct parts like so many bands interlarded with fat.

204. The anterior and middle ligaments of the outer angle, being more or less broad, are fixed in the outside of the astragalus; the posterior, which is the narrowest and pretty thick, is chiefly fixed in the outside of the great portion of the *Os Calcis*.

205. All these ligaments lie on the outside of the capsula, which surrounds the articulation of the astragalus with the bones of the leg.

206. The

206. The ligaments by which the bones of the tarsus are connected with each other, are short, flat, of different breadths, and run from one bone to another in various directions. They are all superficial, except one, by which the astragalus is tied to the Os Calcis, and for the most part are either superior or inferior, the lateral ligaments being but very few in number.

207. Some of them are partly common to several bones, and partly belong only to two; that is, the superficial strata of their fibres run over one bone into the following, and sometimes further; but the strata next the articulation are generally confined to two bones only.

208. The astragalus is tied to the other bones of the tarsus, by several true ligaments, *viz.*

209. To the inside of the Os Calcis by a ligament which comes from the posterior internal tuberosity of the body of the astragalus, and is fixed in an equality behind the lateral apophysis of the Os Calcis.

210. To the inside of the same bone by a ligament which comes from the lateral apophysis of the Os Calcis, and is fixed in a sort of cartilaginous production on the inside of the neck of the astragalus.

211. To the outside of the same bone by two ligaments which come from the edge of the oblique inferior depression of the astragalus, and afterwards separating a little, are fixed in the outside of the great apophysis of the Os Calcis, one forward, which seems to send off a small portion to the Os Cuboides, the other backward, of different breadths.

212. To the Os Scaphoides superiorly by a ligament which goes from the neck of the astragalus to the upper part of the Os Scaphoides, and from thence is extended to the middle Os Cuneiforme.

213. To the same bone interiorly by two ligaments, one of which is a continuation of that which goes from the lateral apophysis of the Os Calcis to the cartilaginous production of the astragalus; the other is near the same production, being partly covered by the former, and fixed in the tuberosity of the Os Scaphoides.

214. To the Os Calcis, by a ligament which comes from the oblique inferior depression of the astragalus, and is fixed in the oblique superior depression of the Os Calcis.

215. If to these principal ligaments of the astragalus, we add

add several others less remarkable, and also those by which it is tied to the ancles, their number will be very considerable.

216. The capsular ligaments go very little further than the edges of the articulations of this bone with the rest. They adhere very closely to the true ligaments, and are covered and hid by them.

217. The Os Calcis is joined to the outer ancle and astragalus by the ligaments already described. It is likewise connected to the Os Scaphoides and Os Cuboides by several ligamentary planes.

218. It is connected to the Os Scaphoides. (1.) By a continuation of the ligament that goes from its lateral or internal apophysis to the cartilaginous production of the astragalus. (2.) By a ligamentary plane which goes from the inferior tuberosity of its great apophysis, and is fixed in the inferior part of the circumference of the Os Scaphoides. (3.) By a narrower ligament which goes from the superior and internal part of the same apophysis, and ends in the nearest part of the circumference of the Os Scaphoides.

219. It is connected to the Os Cuboides. (1.) By a ligament, or rather by several ligamentary fasciculi which go from the extremity of its oblique superior depression to the contiguous angle of the Os Cuboides. (2.) By one lying between the first, and the small external lateral tuberosity of the Os Calcis, and inserted in the Os Cuboides near the first. (3.) By one which is fixed to the exterior and inferior part of the great apophyses of the Os Calcis, and to the contiguous part of the Os Cuboides. (4.) By a pretty broad plane which covers the inferior part of the Os Calcis, and which from the anterior tuberosity of this part, spreads over the contiguous inferior part of the Os Cuboides, and ends in the oblique eminence of that bone. (5.) By a broader plane, which having filled the lower part of the lateral concavity of the Os Calcis, is chiefly inserted in the contiguous angle of the Os Cuboides.

220. The capsular ligaments agree with those of the astragalus.

221. The Os Scaphoides is tied to the astragalus and Os Calcis in the manner already said.

222. It is likewise joined to the Os Cuboides and the Ossa Cuneiformia by several ligaments. On the outside, or that
next

next the Os Cuboides, there is one which connects it to the contiguous angle of that bone. On its upper part, two go from its circumference, one to the second, the other to the third Os Cuneiforme. On its interior side, it is joined to the convex side of the great Os Cuneiforme by two ligaments. On its lower side it has four, whereof the first appears as if it were double, going from the tuberosity of this bone to the basis of the first Os Cuneiforme; the second and third go obliquely to the other two Offa Cuneiformia; the fourth is a little transverse, being fixed in the inferior internal angle of the Os Cuboides.

223. The Os Cuboides, besides the ligaments which tie it to the astragalus, Os Calcis, and Os Scaphoides already mentioned, has others which connect it above, below, and on the outside with the third Os Cuneiforme, and two last bones of the metatarsus. The superior ligaments are almost equally flat, the inferior unequally thick, and stronger than the superior. The exterior goes from the Os Cuboides to the tuberosity in the basis of the last bone of the metatarsus, and seems likewise to communicate with the third bone by some ligamentary fibres.

224. The three Offa Cuneiformia are fixed to the Os Scaphoides and Os Cuboides, by the ligaments above mentioned. They are connected together on the upper part by particular ligamentary planes which go more or less transversely from one bone to another, being all joined to one common ligamentary plane which covers these three bones, and also the Os Cuboides. On the lower part they are joined by stronger and thicker ligaments. They are likewise connected by ligaments to the three first bones of the metatarsus.

225. The great Os Cuneiforme is joined on its upper, lower, and interior or convex side, to the basis of the first metatarsal bone, by ligamentary fibres, which form almost a continued plane, the inferior part of which is strong and thick, and appears to be double. It is likewise tied to the inside of the basis of the second metatarsal bone, by a particular ligament.

226. It has likewise on the outside of its inferior part three considerable ligaments more or less oblique; the first and shortest of which goes to the basis of the second metatarsal

tarfal bone, the second to that of the third, and the third, which is the longest, to that of the fourth.

227. The bones of the metatarsus are connected together by their bases and heads. The ligaments that go between the bases are superior and inferior. The superior are flat and small: the inferior strong and thick, and as it were multiplied by entering the interstices between the bases.

228. The ligaments which go between the heads have nearly the same general disposition. The inferior have this peculiar to them, that, by filling the spaces between the heads, they keep them at some distance from each other. The inferior portions of these ligaments are fixed in the angles at the lower part of each head. They are moreover strengthened by their union and intertexture with the aponeurosis plantaris as shall be said hereafter.

229. The first phalanges of the toes are tied to the heads of the metatarsal bones, by a sort of orbicular ligament, set round the edges of the cartilaginous portions of the head, and those of the bases of the phalanges.

230. In the four toes, next the great toe, the inferior part of these ligaments is very thick, and crufted over as it were with the cartilaginous substance fixed to the basis of the phalanges, and from thence continued over the head of the metatarsal bone next it. This substance grows hard with age, like a sesamoide bone.

231. Of these sesamoide bones, the great toe has two belonging to the first phalanx, which are the largest, the soonest formed, and most considerable of all that go by that name. They are shaped like an olive, being about one third part of an inch in length, and about half as broad as long. They are joined by their anterior extremities, to the basis of this phalanx, close by each other, and lie in the two depressions, on the lower side of the head of the first metatarsal bone.

232. The second and third phalanges of all the toes being articulated by ginglymi, have lateral ligaments, which go between the sides of the bases, to the sides of the heads. At the inferior edges of all these bases, there is a cartilaginous matter, joined to the ligaments, which hardens with age, in the same manner as those of the first phalanges.

233. The capsular ligaments of all these articulations are disposed

disposed in the same manner as in the first bones of the tarsus already described.

234. The annular ligaments and ligamentary vaginae, found on the surface of many of these bones, contribute nothing to their connection, and therefore shall be explained in another place.

235. The periosteum, which covers all these bones, is of the same kind with that of the bones of the leg. *Periosteum, marrow, and mucilaginous glands of the bones of the foot.*

236. The marrow is suitable to their internal structure, that is, in moleculae in the cavernous portions, and in masses in those which have large cavities. Thus the marrow of all the tarsal bones is dispersed in moleculae, because their internal structure is spongy. In the metatarsal bones and first phalanges of the toes, it is disposed in the same manner as in the tibia and fibula, that is, it lies in moleculae in the extremities, the structure of which is cavernous; but in the middle portions of them it lies in masses greater or less, according to the size of the cavities. In the other phalanges, which are entirely spongy, it is accordingly disposed in moleculae.

237. The mucilaginous glands answer in number and figure to the depressions between the cartilaginous edges and ligaments.

§ 2. *The fresh bones of the upper extremity.*

238. The scapula in many subjects has a small cartilaginous border along its whole basis, which in children is remarkable enough, but in full-grown persons it disappears. *Cartilages of the bones of the shoulder.*

239. The glenoid cavity of this bone is covered with a cartilage, which is thicker toward the circumference than in the middle, and a little raised above the edge of the bone. This thickness of the cartilaginous circumference makes the cavity greater than it appears in the skeleton; and sometimes in place thereof there is an additional border, which is thick at the circumference of the cavity, thin towards the bottom, and very narrow. It is of a pliable slippery substance, yet something different from that of a cartilage, resembling,

sembling, in some measure, the border of the coryloide cavity of the Os Innominatum.

240. The small cartilaginous surface of the acromion, mentioned in the treatise of dry bones, is thicker in the natural state, and very little convex.

241. The small triangular surface, at the extremity of the spine of the scapula, near the basis, is covered with a very thin smooth cartilaginous lamina; but being transparent, it does not appear very white.

242. There are no other cartilages commonly found in the scapula, though we sometimes observe in dry bones several places which seem to have been cartilaginous; but this is owing to the dried remains of ligaments and tendons.

243. The sternal extremity of the clavicle is crufted over with a cartilage, which is a little convex, and covers its whole triangular surface; besides which, it has another moveable common cartilage, which shall be explained together with those of the sternum.

244. The small cartilaginous surface of the humeral extremity of the clavicle, answering to that of the acromium, is much thicker in fresh than in dry bones, and appears like that of the acromium, to be a little convex.

245. Between these two cartilages of the clavicle and acromium, there is in some subjects a thin interarticular cartilage, very smooth on both sides.

246. The articulation of the acromium, with the extremity of the clavicle, is strengthened quite round by several small strong ligaments, which go from *Ligaments of the bones of the shoulder.* one bone to the other. These ligaments lie very near each other, and are withal so tightly braced over the joint, as to hide it altogether, and they appear more like a cartilaginous covering, than a ligamentary texture. The internal surface of these ligaments is lined with the capsula of the joint.

247. When the small interarticular cartilage is found, its whole circumference is connected to these ligaments.

248. The articulation of the clavicle with the sternum, is sustained by several ligaments fixed by one end, round the pectoral extremity of the clavicle, near the edge of the triangular surface, and from thence passing over the interarticular

cular cartilage, are inserted by the other end in the sternum, in the manner hereafter to be related.

249. There is a long, narrow, strong ligament, which goes from one clavicle to the other, behind the furca of the sternum, being fixed to the internal angle of the contiguous extremities of the bones. It may be called *the interclavicular ligament*.

250. The neck of the scapula, at a small distance from the edge of the glenoid cavity, gives insertion to the capsular ligament or mucilaginous bag, and to the articular ligaments of the joint of the scapula and Os Humeri.

251. Besides these articular ligaments of the scapula, there are three ligamentary cords fixed to the tuberosity of the coracoid apophysis, two of which, by their other extremities, are inserted in the oblique eminence on the lower side of the humeral extremity of the clavicle; the third, under the acromium. There is likewise a thin flat broad ligament, reaching between the crista of the spine of the scapula, and the edge of the inferior costa.

252. The cartilage by which the hemisphere of the head of the Os Humeri is covered, is gradually thicker toward the middle than toward the edges. *Cartilages of the Os Humeri.*

253. The four surfaces of the tuberosities which appear cartilaginous in dry bones, serve only for the insertion of the tendons of four muscles which move the Os Humeri on the scapula.

254. The channel or sinus, between the two tuberosities, is partly covered by a thin crust, which appears rather ligamentary than cartilaginous, and partly by a tendinous stratum, of which hereafter.

255. The trochlea and small head of the lower extremity of the Os Humeri are covered by a common cartilage, in which the same proportion of thickness is observable, as in that of the upper extremities. This holds pretty generally of all the convex articular cartilages.

256. The fossulæ near the pulley and small head are covered with a kind of thin cartilaginous or ligamentary varnish.

257. The capsular or mucilaginous ligament loosely surrounds the whole articulation. *Ligaments of the Os Humeri.*

of the scapula with the head of the Os Humeri. From its insertion round the edge of the glenoide cavity already mentioned, it is continued over the hemisphere of the head of the Os Humeri, and fixed near its edges, towards the muscular surfaces of the great and small tuberosities.

258. Afterwards parting from them on both sides, in the large space left between the two tuberosities, that is, between the small tuberosity and the lowest surface of the great tuberosity, it runs down gradually on the neck of the bone below the lowest part of the cartilaginous hemisphere.

259. In all this course, the capsula is closely fixed in the bone, except in the small space left between the two tuberosities, that is, at the channel or sinus already mentioned; where it forms a production like the tube of a funnel, proportioned to the capacity of the channel, and strongly fixed in the upper portion thereof. This membranous tube is the vagina of the interarticular tendon of the biceps, which shall be described in the treatise of the muscles.

260. The true ligament of this joint is, in some measure, of that kind mentioned N^o 37. 38. that is, which seem to be made up of two sorts of ligaments closely united together, viz. of a capsular ligament which surrounds the whole articulation, and of several true ligaments which run over, and closely adhere to the former at different distances.

261. Thus the capsula or mucilaginous bag of this articulation is in part strongly united to four flat tendons inserted in the two tuberosities; and in part covered by true ligamentary bands, which, between the four tendons, and on both sides of the first and last, form a considerable thickness. The rest of the space between the first or superior plane of the great tuberosity, and the small tuberosity, is so little provided with ligamentary fibres, that it has been believed to be altogether without them; and anatomists have satisfied themselves with telling us, that in these places the orbicular ligament is very rough on the outside, but shining and smooth on the inside.

262. The interarticular tendon of the biceps, which has been already mentioned in speaking of the production of the capsular ligament of the head of the Os Humeri, and which is contained in the articulation much after the same manner as the interarticular ligament of the head of the Os Femoris,

ris,

ris, called improperly *ligamentum teres*, might be properly enough described in this place, but I chuse to refer it to the muscles.

263. On the body of the Os Humeri, there are two particular ligaments which I term *intermuscular* or *lateral*, of the same kind with those mentioned, No. 52. They are long, flat, thin, strong, and narrow, fixed by one edge along the two lower thirds of the bone, and reaching to both condyles. They are braced pretty tight, and are very narrow at the upper part, but broader toward the condyles.

264. The lower extremity of the Os Humeri is joined to the bones of the fore-arm by two fasciculi of ligamentary fibres, one fixed to the internal condyle, the other to the external. Each fasciculus is composed of fibres closely joined together at the condyle, and afterwards parting in distinct bands like a goose's foot.

265. The capsular ligament is fixed to the condyles, and there covers them; and afterwards it is fixed round both sides of this lower extremity above the fossulæ. Its insertion in these sides is archwise, so that it is there at a much greater distance from the articulation than at the condyles. The fossulæ are slightly varnished over with a cartilaginous substance.

266. This capsula appears to be strengthened by a ligamentary web, the fibres whereof cross each other in different directions; but we must not take for ligamentary filaments, some tendinous fibres of muscles to which the capsula adheres very closely. It appears larger and looser when the muscles are separated from it, than in its natural state when closely united to the muscles.

267. The two sigmoide cavities in the upper extremity of the ulna are covered by a cartilage common to both, which is a little interrupted about the middle of the edges of the cavities by the transverse notches mentioned in the treatise of dry bones.

*Cartilages of
the bones of
the fore-arm.*

This cartilaginous crust seems to be thicker at the edges than in the middle.

268. The inferior extremity or small head of the ulna, is crufted over by a cartilage, round its cylindrical border, in the notch near the styloide apophysis, and for some space on the apophysis itself.

269. The

269. The cartilage which covers the head of the radius, is likewise stretched over the cylindrical border thereof; and a lateral portion of the muscular tuberosity immediately below the neck, is also covered with a thin shining cartilage.

270. All the concave side of the basis of the radius is cartilaginous, and often divided by a small cartilaginous prominent line. The lateral notch of the basis is likewise covered by a continuation of the same cartilage.

271. The lateral half-grooves or channels of the basis of this bone, appear likewise to be crufted over with a cartilaginous matter; but this I rather take to be portions of the annular ligaments, which shall be hereafter described.

272. At the basis of the radius there is likewise a particular additional cartilage, or triangular production longer than it is broad, very thin, and rather flat than concave on both its smooth sides. It is fixed by its basis, or shortest side, to the lateral sigmoide notch of the basis of the radius, in such a manner as that one side of it is on a level with the large cartilaginous surface of the basis of the bone, and its apex directly opposite to the styloide apophysis. The other side touches the flat extremity of the small head of the ulna, but is not fixed to it.

273. This cartilage is one of those mentioned, No 26. 27. and may be termed the *interarticular cartilage* of the joint of the wrist. It is tied to the radius by very short ligaments, and sliding on the small head of the ulna, it follows all the motions of the radius. It is therefore a sort of articular production of the lower side of the basis of the radius, and fills, in the natural state, the void space which in the skeleton appears between the end of the ulna and the neighbouring bone of the carpus.

274. Some of the ligaments of the bones of the fore-arm are common to them with the Os Humeri, some common to them with the bones of the hand; and some are proper. These last are two in number, one called the *interosseous ligament* of the fore-arm, and one which may be termed the *coronary ligament* of the radius. To these may be added the annular ligaments, which only serve for the passage of tendons; and other ligamentary expansions, which may be called *muscular ligaments*.

275. The

275. The interosseous ligament of the fore-arm is very like that of the leg. It is fixed by one edge, along the sharp angle of the ulna, and by the other along that of the radius. It is principally made up of two very strong planes of fibres, which cross each other at oblique angles, and leave holes at different distances for the passage of the blood-vessels.

276. This ligament ties the two bones closely together, and the two planes serve for the insertion of several muscles. In the supination of the hand it is very tightly braced, but in pronation it is folded a little lengthwise.

277. The coronary ligament of the radius, is a sort of ligamentary hoop surrounding the circular circumference of the head of that bone, reaching from one side of the small lateral sigmoide or transverse cavity of the ulna, to the other, in an arch, which is about three quarters of a circle. It is very strong, and comes near the solidity of a cartilage. The side next the radius is very smooth; and though it connects that bone very closely to the ulna, yet it leaves it room enough to turn in the motions of pronation and supination.

278. The capsular ligament of the joint of the elbow runs down from its insertion in the Os Humeri already described, and is fixed in the olecranon round the edge of the great sigmoide cavity, including both the apex of the olecranon and of the coronoid apophysis. It likewise runs over the head of the radius, and is fixed to the coronary ligament, quite round. Thus it completely surrounds the articulation of these three bones, and serves to contain the mucilaginous liquor furnished by the glands and fatty substance, both which are found in the greatest quantities near the extremity of the ulna.

279. The true common ligaments by which the Os Humeri is connected to the bones of the fore-arm, called *lateral ligaments*, are the two fasciculi, which, after being inserted in the condyles of the Os Humeri, are expanded like a goose's foot. That which is fixed in the inner condyle, may be called *brachio cubitale*, and the other *brachio-radiale*.

280. The brachio-cubital ligament running down over the capsula to which it closely adheres, below the great edge of the trochlea of the Os Humeri, is inserted like radii (of which its other extremity fixed in the condyle is the centre) on the
side

side of the great sigmoide cavity of the ulna. It is covered on the outside by several tendons which adhere closely to it, and seem to strengthen it.

281. The brachio-radial ligament is disposed much after the same manner, but is of a greater extent. It is expanded from the external condyle of the Os Humeri, as from a centre, and is inserted round the coronary ligament, and from thence all the way down to the neck of the radius, and also in the neighbouring parts of the ulna. Through all this passage, it covers the capsular ligament, and is covered by several tendons, adhering closely to both.

282. Of the ligaments by which these bones are connected to those of the hand, one is, like a roundish cord, fixed in the styloide apophysis of the ulna, and from thence passes directly over the Os Cuneiforme of the carpus, in which and in other bones it is inserted in the manner that we shall afterwards explain: another pretty broad ligament is fixed in the point of the radius, and by its other extremity in the bones of the carpus.

283. From this styloide ligament of the radius, along each edge of the basis of that bone, are ranks of ligamentary fibres lying much in the same direction with the ligament itself, and continued all the way to the styloide ligament of the ulna; those nearest the ulna inclose the interarticular cartilage of the basis of the radius, and near the styloide ligament of the ulna, there is a particular fasciculus inserted in the point of that cartilage.

284. All these ligaments surround and cover the capsular ligament, so closely, that they can hardly be distinguished from it. The capsula is likewise in part covered by a portion of a great oblique ligament, which being by a very broad insertion fixed in the large extremity of the radius, about two fingers breadth above the styloide apex, afterwards crosses obliquely, partly over the convex side of the basis radii, and partly over that of the carpus, and then turning toward the Os Orbiculare, is inserted therein. It is called *the external transverse ligament* of the carpus, and may likewise be named *the great oblique ligament* of the wrist.

285. There are several small annular ligaments placed at different distances on the convex side of the basis radii, from
its

its styloide apex to its articulation with the extremity of the ulna. They are at least six in number, some of them being often double or triple.

286. The first is fixed in the styloide apex; the second in the groove near that apex; the third in the small narrow or middle groove; the fourth in the groove next the former; the fifth in the corner of the semilunar notch of the basis, at its articulation with the ulna; and the sixth in the extremity of the ulna near the styloide apophysis.

287. These particular ligaments are almost wholly covered by the great oblique ligament already mentioned, and are fixed as strongly in it by one side, as they are in the bones by the other. They are all very strong, and their concave sides serving for fræna to the tendons of several muscles that pass over them, are very smooth, and accompanied with thin mucilaginous vaginæ, which shall be described in the treatise of the muscles.

288. To these we might add the ligamentary expansions, with which several muscles are covered, and separated from each other, as by so many distinct septa, which are all very thick and strong where they are inserted in the bones. One kind of them may be termed *ligamentary bands*, or *muscular vaginæ*, the other *ligamentary septa*, *intermuscular ligaments*, &c. but the description of them must be referred to that of the muscles.

289. All the bones of the carpus, metacarpus, and fingers, are crusted over with cartilages at these places which I termed *cartilaginous surfaces*, in the treatise of dry bones; but in fresh bones they are thicker, softer, and whiter than in the skeleton. In adult subjects their figure remains the same in both, but it changes in the dry bones of younger subjects, and in those of children it is quite different. The impressions and notches in which the mucilaginous glands are lodged, are most sensible in the cartilages of fresh bones, because of their thickness.

*Cartilages of
the bones of
the hand.*

290. The ligaments of the carpus are very numerous. Some of them tie each bone to one or two neighbouring bones in the same rank; and these are composed of a great number of filaments, but so very short as to allow these bones only a small degree of motion. Some of them tie the bones of one row to those of

*Ligaments of
the bones of the
hand.*

the other, which are likewise made up of many filaments, but not so short as the former, and therefore allow these bones a more manifest motion, as we see in bending the wrist. Lastly, there are other ligaments of the carpus, by which the three first bones of the first row are connected to the bones of the fore arm; and to these may be added the ligaments by which the bones of the second row are joined to those of the metacarpus and first phalanx of the thumb.

291. We have already described all the ligaments belonging to the articulation of the carpus with the bones of the fore-arm, except their insertions in the carpus. The styloide ligament of the radius is fixed round the neighbouring tuberosity of the Os Scaphoides. The styloide ligament of the ulna is fixed first in the Os Cuneiforme, and then in the Os Unciforme, from whence it is a little stretched over the fourth bone of the metacarpus.

292. The ligaments which lie between the two former, round the basis of the radius, and a small portion of the head of the ulna, are fixed round the common convexity of the three first carpal bones, as is also the mucilaginous capsula by which these ligaments are lined.

293. Besides all these small short ligaments belonging to each bone in both rows, the rough surfaces of all the bones, especially those which form the convexity of the carpus, give insertion to a great many ligamentary fasciculi, stretched over and closely united to the former small ligaments, and serving probably to strengthen them. Some fasciculi of the same kind are found on the concave side of the carpus, but they are fewer in number, and not so strong.

294. There is likewise a considerable ligament, called the *inner transverse ligament* of the carpus. It was formerly called an *annular ligament*, and may still very justly retain that name, in the sense already explained, when I spoke of ligaments in general.

295. The bones of the metacarpus, besides the short ligaments by which they are tied to the second row of the bones of the carpus, have several others, by which both their bases and heads are connected together. The bases of the third and fourth bones are not so closely tied as the rest, and therefore they have a very sensible motion, which, however, is greater in the fourth than in the third.

296. The

296. The heads of these bones are firmly tied to each other by a strong transverse ligament situated in the palm of the hand, and fixed by distinct productions in the neighbouring part of the heads, in such a manner, as to form, in the spaces between the heads, a kind of perforated fræna, through which the tendons of the flexor muscles of the fingers have a free passage; and these fræna are also supported by aponeurotic expansions, which shall be described in the treatise of the muscles.

297. The first phalanx of the thumb is fixed to the Os Trapezium, by short ligaments which pass obliquely over the articulation. The first phalanges of the other four fingers are joined to the heads of the metacarpal bones almost in the same manner, and by ligaments like the former, which are strengthened by adhering to the transverse ligament already mentioned. The second phalanx of the thumb is joined to the first by ligaments of the same kind.

298. The third phalanx of the thumb is joined to the second; the second phalanges of the other fingers to the first, and the third to the second, by lateral ligaments, almost in the same manner as the bones of the fore-arm to the Os Humeri; that is, these ligaments spread from a point fixed in the lateral tubercles of the heads of the phalanges, and are inserted by their other extremity like radii in the bases of the neighbouring phalanges.

299. The two first phalanges of each finger have a very strong ligamentary vagina inserted in the rough lines or ridges, on their flat sides. These vaginæ are lined with a mucilaginous membrane, which runs like a tube from one phalanx to the other, over the articulation. They serve for fræna to the flexor muscles of the fingers, the tendons of which pass through them.

§ 3. *The fresh bones of the trunk.*

300. The cartilages of all the vertebræ in general are of two kinds; one proper to each vertebra, the other common to the two vertebræ that lie next each other. The first I term *cartilages of articulation*, the others, *cartilages of symphysis*.

Cartilages of the spine.

301. The proper articular cartilages of each vertebra of

the whole spine are those four which cover the surfaces of the four small articular apophyses. In the natural state they are very white and smooth, and much thicker than in dry bones. Their circumference is the same with that of the articulated sides of the apophysis, except in those places where there are small superficial notches. In the first vertebra of the neck and vertebræ of the loins these cartilages are thicker than in the rest.

302. The two inferior articular cartilages of the first vertebra, and the two superior cartilages of the second, seem to be disproportionate, though not so much as in dry bones; and in some subjects we find moveable or interarticular cartilages between the apophyses of these two vertebræ.

303. The first vertebra of the neck has a small cartilaginous incrustation in the middle of the concave side of its anterior arch, answering to another on the foreside of the odontoid apophysis of the second vertebra; so that these two vertebræ have five articular cartilages each, besides the interarticular ones already mentioned.

304. The vertebræ of the back, besides the four cartilages of their small apophyses, have others which do not belong to their articulations with one another, *viz.* those that cover the lateral fossulæ in the bodies of these vertebræ and the fossulæ of their transverse apophyses, by both which they are articulated with the ribs.

305. The cartilages of symphysis lie between the bodies of the vertebræ, one of them being contained between, and closely joined to the lower surface of the body of one vertebra, and to the upper surface of that next under the former; the breadth and circumference of them answering exactly to that of the surfaces to which they are connected; but their height or thickness is different in each class of the vertebræ. In the vertebræ of the loins they are a quarter or third part of an inch in thickness, according to the stature of the subject. In those of the neck, they are not so thick, and the thinnest of all are those of the vertebræ of the back.

306. These cartilages are not of an equal thickness in all their parts. Those of the neck and loins appear to be thickest on the foreside, and those of the back, rather thickest on the backside; but these differences are most remarkable in the vertebræ that lie near the middle of each class.

307. The

307. The internal structure of these cartilages is different from that of all the other cartilages of the body, and indeed they resemble the rest in nothing but in whiteness and elasticity. When we view their circumferences only, they seem to be one uniform mass as the others generally are; but when they are divided by an incision parallel to the surface of the vertebræ to which they are joined, we see that they are made up of a great number of cartilaginous concentrical rings contained within each other, a small distance being left between them. They are closest and thinnest near the centre, and about the middle seem to degenerate into another softer kind of substance.

308. These rings do not form an entire circumference, being turned inward on the backside, answerably to the posterior slope in the body of each vertebra. They lie horizontally, one edge being fixed to the lower side of one vertebra, and the other to the upper side of the vertebra next below the former. The interstices between the rings are filled with a mucilaginous substance, less fluid than that of the joints; and their breadth or height is proportionable to the distance of the vertebræ between which they lie.

309. Each cartilaginous lamina taken separately is very pliable according to its length, but taken altogether, they are not so easily bent, partly because of their circular figure, and partly because of their proximity and multiplicity. They yield, however, in the inflections of the spine; and their external surface, which in the ordinary situation of the spine is even with the surface of the vertebræ, becomes prominent, or jets out on that side toward which the inflection is made, the cartilages being then compressed by the vertebræ.

310. They likewise yield on all sides, without any inflection of the spine, to the weight of the head and upper extremities; but this is done by very small and imperceptible degrees, and most of all, when the upper parts of the body are loaded with any exterior weight.

311. They restore themselves afterwards merely by being freed from compression; so that a man is really taller after lying some time, than after he has walked or carried a burden for a great while; the most natural and simple reason that can be given for the different heights of the same person at different times, first observed in England, and afterwards confirmed

confirmed by M. Morand, a member of the royal academy of sciences, being the different state of the intervertebral cartilages.

312. The intervertebral cartilages of the neck, lying for the most part between the convex side of one vertebra, and the concave side of another, are of a greater extent in proportion to the size of these vertebræ, than those of the back and loins. Without this convexity and hollowness in these vertebræ, which are the least of all, the cartilages could not have been made large enough to be able to resist strains and great motions.

313. The Os Sacrum has no cartilage except that between the upper side of the first false vertebra, and the last vertebra of the loins, and those by which it is connected with the Os Innominata, already described.

314. The intervertebral cartilages of this bone in an adult subject, are too much obliterated to need a description.

315. The cartilages which join the different portions of the Os Coccygis are preserved in some subjects, to a very great age; in others they soon become entirely bony.

316. The vertebræ are strongly connected to each other by three kinds of ligaments. Each vertebra is connected to that above and below it, by a great number of very short and strong ligaments which cross each other obliquely, and are fixed round the edges of the body of each vertebra.

*Ligaments of
the spine.*

317. These crucial ligaments cover the circumference of the intervertebral cartilages, and adhere closely to them. They seem to be looser in the cervical and lumber vertebræ than in those of the back, and by that means yield to the cartilages in the different inflexions of the spine already mentioned.

318. The bodies of all the vertebræ, from the second of the neck to the Os Sacrum, are covered by ligamentary half vaginæ on the convex side, in which these vaginæ are fixed, surrounding all the crucial ligaments, and made up of ligamentary fasciculi and filaments, partly oblique, but mostly longitudinal.

319. All the vertebræ are likewise strongly connected by a ligamentary tube, which lines the inner surface of the medullary canal from the occipital hole to the Os Sacrum, representing

presenting a kind of long flexible funnel, its cavity at the upper part being equal to that of the occipital foramen; and ending in a small point at the Os Sacrum.

320. This ligament is made up of several strata of longitudinal and oblique fibres interwoven together, adhering closely to the inside of the great foramen in each vertebra, by a great number of filaments detached from it to the porous substance of the vertebræ.

321. The first vertebra is not only fixed to the Os Occipitis by a portion of this ligamentary funnel, but also by a distinct and very strong ligamentary covering, which surrounds and adheres very closely to that portion of the funnel. This covering is fixed above, round the great occipital foramen, where it begins to adhere to the funnel, and below, quite round the circumference of the first vertebra.

322. The second vertebra has two ligaments peculiar to it, one which connects the apophysis dentiformis to the Os Occipitis; and another transverse, which confines this apophysis within the anterior portion of the cavity of the first vertebra. The first may be termed *occipital*, and the second the *transverse ligament* of the odontoide apophysis.

323. The occipital ligament is very strong and thick, and adheres in a very singular manner to the three planes of the apex of the apophysis, and is afterwards divided into two or three portions which are fixed in the like manner, in the anterior edge of the great occipital foramen, and in the inequalities of the apophysis basilaris near that hole.

324. The transverse ligament may be said more justly to belong to the first vertebra, both ends of it being inserted in the lateral impressions of the inner surface of that vertebra mentioned in the description of the skeleton. But it is ranked among the ligaments of the second vertebra, because of its use, and because of the insertion of its middle portion.

325. This thick ligament is stretched from one side of the inner surface of the first vertebra, to the second. About the middle of the foreside, its texture is very close, and it is fixed by this portion in the back part of the apophysis dentiformis, and sometimes it seems to have additional fasciculi which adhere by one end to both extremities, and by the other, to each side of the apophysis.

326. Along the whole bony canal of the spine, between the

the bases of each spinal apophyses, lies a flat and very elastic ligament of a yellowish colour, which fills up the posterior great notches of the vertebræ, adhering to their edges; and likewise to the neighbouring portions of the funnel or great ligamentary tube.

327. Between the extremities or apices of the spinal apophyses we find small ligamentary ropes which go from one spine to that next it; and which are really double, though they seem to be single in the vertebræ of the back and loins. In the vertebræ of the neck, they are fixed separately to the forked extremities of the spines.

328. Between all the spinal apophyses, from their apices to the middle of the bases, lies a ligamentary membrane going between each two apophyses, and thereby distinguishing the right side of the vertebræ from the left. There is a ligament of the same kind between the transverse apophyses.

329. These are intermuscular ligaments or ligamentary septa, which divide the muscles of one side from those of the other, as was already observed in speaking of the ligaments in general, and will appear more particularly in the description of the muscles. The first kind may be termed *interspinales*, the other, *intertransversales*.

330. The articular ligaments of the spina dorsi, are those which tie the glenoid cavities of the first vertebra to the condyles of the Os Occipitis; those that join the cartilaginous surface of the apophyses dentiformis, to the anterior cavity of the first vertebra; and those by which all the oblique or articular apophyses are connected together.

331. These are all small, short, strong ligamentary fasciculi, fixed by both extremities, round the cartilaginous surfaces of the apophyses, surrounding very closely all the capsular ligaments of these articulations.

332. The vertebral ligaments of the ribs, or those which connect the ribs to the bodies and transverse apophyses of the vertebræ of the back, are of the same kind, being inserted round the cartilaginous fossulæ, in the body and apophyses of each vertebra.

333. Besides all these ligaments of the spina dorsi, there is one which goes in form of a membrane, from the Os Occipitis, all the way to the last two vertebræ of the neck. It

is

is broad at the upper part, and from thence diminishes gradually. By its upper broad extremity, it is fixed along the occipital spine, and by one edge, in the posterior tubercle of the first vertebra, between the two spinal furcæ of the following vertebra, and in the apices of the spinal apophyses of the lowest vertebra; but the other edge is loose. This is a true intermuscular ligament, and I give it the name of *ligamentum cervicale posterius*.

334. There are two lateral ligaments of the same kind, fixed to the transverse apophyses of the vertebra of the neck, which shall be described together with the muscles.

335. The ligaments belonging to the Os Sacrum were described near the beginning of this account of the fresh bones.

336. The sternum of an adult subject has commonly sixteen cartilages, fourteen of which are articular, the other two symphyses. Of the articular cartilages, two belong to the articulations of the clavicula, and twelve to those of the true ribs, from the second to the seventh inclusively. The two symphyses are those between the sternum and the first rib on each side.

Cartilages of the sternum and ribs.

337. There is likewise another symphysis by which the upper portion of the sternum is connected to the lower, the cartilage of which is often obliterated in an advanced age.

338. The apophysis ensiformis is often bony toward the sternum, and more or less cartilaginous at the other end. In very aged persons it has been found entirely ossified; and sometimes wholly cartilaginous, even in adults.

339. All the ribs have cartilaginous portions, which differ from each other in length, breadth incurvation, adhesion, and in their extremities, all which were explained in the description of the skeleton. We have only to observe here, that these cartilages are whiter, more polished, broader, and thicker in the natural state than when they are dried.

340. The cartilages of the false ribs are naturally more slender and pliable than those of the true ribs, the middle or inner substance of which acquires the consistence of bones in old age, and their extremities sometimes ossify, and are immovably fixed to the sternum.

341. The sternum has several ligaments by which it is

*Ligaments of the
sternum and ribs.*

connected with the clavicles and ribs. It is joined to the clavicles by strong short ligaments, fixed by one extremity round the edges of its two superior notches, by the other, in the extremity of each clavicle, and by the middle, to the interarticular cartilages already explained, surrounding the particular ligaments which go between the edges of these cartilages and the sternum, and the capsular ligaments between them and the clavicles.

342. All the ribs are connected to the bodies of the vertebræ by strong short ligamentary fasciculi, fixed by one end round the fossulæ in the vertebræ, and by the other round the head of each rib. The ribs are likewise tied to each other by thin ligaments, which go obliquely from the cartilage of each rib to that of the next.

343. The ten uppermost ribs on each side are connected to the transverse apophyses of the vertebræ of the back, by strong short articular ligaments fixed to the tuberosities of the ribs, and round the fossulæ of the apophyses, much in the same manner with those which go between the heads of the ribs and bodies of the vertebræ. Both these articulations are provided with capsular ligaments.

344. The eleventh rib on each side, having no articulation with the transverse apophyses, is connected to them by auxiliary strong short ligaments fixed in its neck.

345. The last rib is only joined by its head to the body of the twelfth vertebra of the back; but it is connected in a particular manner to the transverse apophysis of the first vertebra of the loins, by a broad ligament fixed in the whole upper edge of the apophyses, and in the lower edge of the rib through about two thirds of its length.

346. The first true rib has no ligamentary connection with the sternum, the cartilaginous symphysis being sufficient. The rest are closely joined to that bone by small ligamentary portions, fixed by one end round the extremity of the cartilage, and by the other, round the notches in the sternum. On the upper and lower sides of each articulation, these ligaments are very short, but on the foreside they are expanded over the sternum in a radiated manner.

347. The cartilage of the first false rib is joined to that of the last true rib, by several short filaments, which go
from

from the lower edge of the one to the upper edge of the other, near its small extremity. The other false ribs are connected together much in the same manner, with this difference only, that the filaments by which the fourth rib is connected to the third, are longer than those above them; and those between the fifth rib and the fourth much longer than any of the rest; and for this reason these two ribs are less steady than the others.

348. The ligamentary expansions of the vertebræ are in place of a periosteum, both outwardly and inwardly. The sternum and bony portions of the ribs have a periosteum like the other bones. The

The periosteum, marrow, and mucilaginous glands of the vertebræ, sternum, and ribs.

cartilaginous portions of the ribs are covered by a membrane of the same kind, termed *perichondrium*. As the internal structure of these bones is cellulous or spongy, they contain only small separate portions of marrow, or a red medullary juice, like that in the vertebræ.

349. The mucilaginous glands of all these articulations are very small, but are accompanied by many fatty molecules lying round each joint. The inner surface of the ligamentary tube which lines the bony canal of the spine, is lubricated by an oily or adipose substance, which shall be spoken to in the description of the brain.

§ 4. *The fresh bones of the head.*

350. The condyloide apophyses of the Os Occipitis, the glenoide cavities or articular fossulæ of the *Cartilages.* Offa Temporum, the eminences next these cavities, and the condyloide apophyses of the lower jaw, are all crusted over with very white and smooth cartilages; and there is likewise an interarticular or moveable cartilage in each articulation of the lower jaw, with the temporal bones.

351. This cartilage is thick near the circumference, very thin and transparent, and sometimes perforated in the middle. The lower side is uniformly concave, answering to the oblong convexity of the maxillary condyle; but the upper side is partly concave, and partly convex, suited to the fossula and eminence in the temporal bone. The mechanism

of this cartilage shall be explained in the description of the muscles.

352. The remaining cartilages of the bones of the head, viz. the cartilaginous septum and other cartilages of the nose; the small cartilaginous ring in each orbit; the cartilages of the outward ear; and those which are joined to the Os Hyoides, must be referred to the description of the viscera.

353. The ligaments of the bones of the head are these. *Ligaments.* (1.) Those between the occipital condyles and the superior apophyses of the first vertebra of the neck. (2.) Those between the Os Occipitis and apophysis dentiformis of the second vertebra. (3.) Those of the articulation of the lower jaw with the temporal bones. (4.) Those by which the Os Hyoides is connected to the styloide apophyses. I here pass over the ligaments which connect the cartilages of the ear, those of the nose, the small cartilaginous pulleys of the orbits, and the ciliary cartilages.

354. The ligaments of the occipital condyles resemble the articular ligaments of the vertebræ, consisting of a strong texture of ligamentary filaments placed close by each other round the whole articulation, and fixed by one end in the occipital bone, by the other in the edges of the superior apophyses of the first vertebræ, and surrounding the capsular ligaments.

355. The ligaments which go from the Os Occipitis to the apophysis dentiformis, are very thick, and disposed in separate fasciculi which afterwards unite. The fasciculi are fixed immediately before the great occipital foramen, in the lower side of the apophysis basilaris, and the united ligament is inserted in the odontoide apophysis in the manner already said.

356. The ligaments of the articulation of the lower jaw are very strong, and are disposed and inserted much in the same manner with those by which the clavicle is connected to the sternum. They are fixed by one extremity round the glenoide cavity or articular fossula and eminence of each temporal bone, by their middle, round the interarticular cartilage, and by the other extremity, round each condyle of the lower jaw. The disposition of the capsular ligament with

with respect to the interarticular cartilage, is the same as in the articulation of the clavicle with the sternum.

357. The bones of the head, as well as all the other bones of the human body, are covered by a particular membrane, of which that part which belongs to the scull, is termed *pericranium*, and that which covers the bones of the face, or of the two jaws, is called simply *periosteum*. This membrane shall be more particularly described among the other soft parts of the head.

358. The internal structure of the bones of the head being for the most part cellulous, they contain also distinct portions of marrow included in membranous cells lying in the diploë.

359. The sinus frontales, maxillaris, and sphenoidales, are lined with a glandulous membrane which secretes a mucilage very different from that of the joints, as we shall see in another place.

360. The true mucilaginous glands of the occipital and maxillary articulations, have nothing peculiar to them. They are proportioned to the joints to which they belong, and lie between the capsular ligaments and circumference of the cartilages.

S E C T.

S E C T. III.

A description of the Muscles.

A R T. I.

The general doctrine of the Muscles.

1. **A**LL the motions of the human body, whether general or particular, whether natural or preternatural, are immediately performed by organs which

Situation in general. anatomists name *muscles*; and these are found in all the moveable parts of the body. I do not here speak of motions caused merely by the elasticity of certain parts, by external impulses, or by the force of gravity.

2. The muscles in general are bundles of fibres of different figures and sizes, and for the most part consisting of two different portions; one whereof is thick, soft, more or less red, and sometimes pale, forming what is called the *body, fleshy substance, or belly* of the muscle. The other is thin and small, of a close contexture and very white, forming the extremities and other parts termed by anatomists *tendons* or *aponeuroses*. The fleshy portion is the principal and essential part of the muscle, being never wanting; but the tendinous or aponeurotic portion is in some muscles so very small as to be invisible. Both portions are covered by a particular membrane.

3. The ancients who compared a muscle to a rat or other animal head, divided it into the head, belly, and tail; but the moderns finding this comparison very lame and faulty, have left off the use of all the terms arising therefrom except that of belly; and instead of the other two, they use those of beginning or origin, and insertion. Some of the latest authors think it most proper to call one end of the muscle, the *fixed point* or *fulcrum*, the other the *moveable point*.

4. All these terms, whether old or new, tend to mislead

us, and that of fulcrum is without foundation. The best and most simple division of a muscle is into the body or fleshy portion, which in some muscles may be termed the *belly*, and the extremities, whether tendinous, aponeurotic, or fleshy.

5. The fibres, of which a muscle is made up, go by the general name of *moving fibres*, and each of them, as well as the whole muscle, is partly *Internal structure.* tendinous and partly fleshy. They are for the most part ranked in fasciculi, in a lateral situation with respect to each other, and distinguished by membranous, cellular or adipose septa, as by so many particular *vaginæ*.

6. These fibres are connected to each other, and to the intermediate septa by a great number of very small fine filaments, the capillary extremities of arteries, veins, and nerves running over them; and they are inclosed in a thin, membranous, cellular covering, called the *proper membrane* of the muscle, being a continuation of the septa or *vaginæ* already mentioned.

7. All these septa or *vaginæ* communicate with each other, by a mutual and reciprocal continuation of their cellulous texture, and they are bound down transversely by filamentous or fibrous pellicles, which cross them at small distances from one another, and lie nearly in the same direction through the whole body of the muscle. The same sort of *fræna* are observable between the moving fibres, which connect them together, and appear to be in some measure nervous.

8. The particular structure of each moving fibre is not as yet sufficiently known. They may all be divided into several smaller fibrillæ; and the substance of their fleshy portion is believed by some to be cellulous, by some to be vesicular, and by others to be spongy or medullary. Some of the ancients imagined this portion to be hollow, and that it contained a sort of pulp called by them *tomentum*, more or less saturated with blood.

9. When we examine a moving fibre through the best microscopes, both the fleshy and tendinous parts of it appear contorted, but the latter not so much as the former. Having injected any coloured penetrating liquor, we may, by the help of an ordinary microscope, discover a very fine and close vascular net-work which insinuates itself between all the fibres,

fibres, covering or being twisted round them, and likewise spread on the septa.

10. The fleshy portion may be contracted or shortened, and relaxed or elongated. The tendinous portion yields but very little, resisting any force tending to prolong it, except it be so violent as to disorder its texture.

11. The disposition of the moving fibres is different in different muscles, and their tendinous and fleshy portions do not always lie in the same straight line, but make opposite angles with each other. In some muscles the fleshy portion is not all of the same length, in others it is nearly equal, but the fibres unequally and gradually disposed at the sides of each other, forming all together an oblique plane.

12. Some are disposed like radii, other form planes more or less incurvated; and some form complete circumferences, the two extremities meeting and uniting together.

13. The tendinous portions being only the supplement of the whole length of the muscle, may be of equal or unequal lengths, according to the disposition of their insertions. They may be very short at one end of the muscle, and very long at the other. When the fleshy plane is partly oblique, they vary gradually in length; and when that obliquity is reciprocal at both ends, in form of a lozenge, the tendinous portions are alternately long and short.

14. In some muscles, each moving fibre is nearly of the same length with the body or belly of the muscle; in others the fleshy fibres are very short, though the body of the muscle formed by them be very long. In the first kind, the fibres run more or less straight from one end to the other, and are never very numerous. In the second they are situated obliquely, and are consequently in great numbers; so that the length of each fibre is not always to be measured by that of the body of the muscle to which it belongs.

15. These different portions of fibres are not equally to be met with in all muscles. Some have two or more tendons, some only one, but of different lengths; others have none at all, or at least none that can be perceived, as has been already said.

16. But there is no muscle without a fleshy portion, which, alone being capable of contraction, is absolutely necessary; whereas

whereas the tendons in many places are only productions, by which the muscles are fixed to parts at a distance from them.

17. Many muscles are observed to be covered by an aponeurotic expansion, of different degrees of strength and size, which seems to arise from one or more of the neighbouring tendons. In proportion as it is extended it grows thinner, and then loses itself in the cellular membrane, called formerly the *common membrane* of the muscles.

18. There are likewise strong ligamentary membranes of another kind, by which many muscles are covered as by a girth, and which may be termed *broad or ligamentary bands or coverings*. They are made up of several planes of strong white shining fibres, crossing each other, and they are strongly fixed along one or more bones, almost in the same manner as the interosseous ligaments of the fore-arm and leg. They furnish septa or common vaginae to the muscles which they cover, and likewise particular vaginae to the tendons, thinner than those of the fleshy portions.

19. These common bands and vaginae serve to gird and confine the muscles, and to keep them in their places in great efforts. They likewise in some measure supply the place of tendons, and multiply the insertions. The loose portions of these membranes are lined on the inside with other very fine membranes, which are continually moistened by a mucilaginous liquor, to preserve the muscles and tendons contiguous to them, from friction.

20. Besides these bands and septa there are other ligamentary fræna peculiar to the long tendons, called by the name of *annular ligaments*, the general history of which is to be found in the description of the fresh bones.

21. The difference of muscles is very considerable, and depends on many circumstances, the chief of which are the size, figure, direction, situation, *Difference, and names.* structure, connection, and use; and it is from these differences that the names of the greatest part of the muscles are taken. From their size they are termed *great, middle, small, long, broad, thin*: from their figure, *triangular, scalenous, square, rhomboidal, indented, orbicular, deltoide*: from their direction, *straight, oblique, transverse*: from their situation, *superior, inferior, external, internal, anterior, posterior, right, and left*: these four differences, and the names derived

from them, are easily comprehended; but what relates to the other three, requires a little farther explication.

22. With respect to their structure, muscles are either simple or compound. Simple muscles are those whose fleshy fibres, or rather the fleshy portions of their moving fibres, are all uniformly disposed, and terminate in tendons lying either in a straight or oblique line, in the manner already explained

23. Compound muscles are those whose fleshy fibres are disposed obliquely in several particular ranks, representing the same number of simple muscles with their fibres lying in opposite directions. In proportion to the number of these ranks or series, the muscle is said to be more or less compounded.

24. When the compound muscle is made up of two simple muscles only, these are so disposed as to represent a feather, and the compound muscle is from thence termed *penniform*. In some of these muscles one of the tendons appears to be slit or divided, in order to contain the fleshy portion between its two parts, while the other runs through the body of the muscle, diminishing gradually in size as it advances, in the same manner as we see in a feather. In others there is only one middle tendon between the series of fleshy fibres, which are by their other extremity fixed to other parts. In more compound muscles, the tendons at one extremity may all unite together, while those at the other remain divided.

25. But there are still other kinds of compound muscles. Some are made up of two placed endwise, and joined together by a common tendon; so that this tendon, the two muscles, and the two tendons at their extremities, lie all in a line, and form the whole length or extent of the compound muscle, which is termed *digastricus* or *biventris*; and if three muscles be thus joined, the compound is called *trigastricus*.

26. Some are made up of two muscles more or less in a lateral situation with respect to each other, and united at one extremity; others are made up of three or four muscles situated in the same manner; and if they are united at that extremity, which the ancients called the *head of the muscle*, they are called *bicipites*, *tricipites*, &c. according to the number of these heads; but if they are joined at the other extremity, they are termed *bicornes*, *tricornes*, &c.

27. The muscles are fixed by their extremities to different parts, and in different places of the human body. *Connection.*
 The greatest part of them are inserted in bones alone. Some are fixed partly to bones and partly to cartilages, as those of the ear and nose; some partly to bones, and partly to the integuments, as several muscles of the face, which may therefore be termed *semicutaneous*, in imitation of those in brutes, which being inserted in the integuments alone, are from thence termed *cutaneous*. In some the fibres make an entire circle, without terminating any where by their extremities; of this kind are several of those called *sphincters*, to which may be added the heart, stomach, and intestines. All the muscles have likewise a sort of connection with the neighbouring parts, but this is only lateral by means of membranes.

28. The names taken from the connections and insertions of muscles are generally of two kinds; one common and referred to some considerable part of the body, *Names.*
 as when we say the muscles of the head, of the thorax, abdomen, arm, leg, eye, lips, &c. the other proper, specifying more particularly the insertions of each muscle, as the mastoideus, sterno-mastoideus, coraco-brachialis, anconeus, peroneus, &c. Some names have no relation to the insertions, as those of ulnaris and radialis, which are given to muscles which lie upon the ulna and radius, without being inserted in either bone.

29. The names of the first kind relate more to the uses of muscles than to their insertions, and are for the most part ill founded, and apt to mislead us, as will appear when we come to the uses of the muscles. The names of the second kind are instructive, and those of the third are tolerable.

30. The general use of the muscles is to move all the parts of the body, whether hard, soft or fluid. Most of the hard and soft parts are moved by these powers being *Uses.*
 fixed to them, and they move the rest without any such insertion.

31. The muscles fixed by both extremities to hard parts reciprocally moveable, may accordingly move either part. Thus the muscles inserted by one extremity to the Os Humeri, and by the other to the ulna, may move the ulna upon the Os Humeri, and the Os Humeri upon the ulna.

32. Muscles fixed by one extremity to hard parts, and by the other to soft parts, cannot perform these reciprocal motions, because in this case the hard parts must remain immoveable, the soft parts only being moved, as in the muscles of the ball of the eye, those of the lips, &c.

33. The fluids, of whatever nature or consistence they be, are moved in some cases by being immediately pushed or projected by the muscles, as we see in the heart, in others by their canals being pressed upon, as in the oblique and transverse muscles of the abdomen; and there are other muscles which stop or retard the motion of the fluids at one time, and facilitate or accelerate it at another, as all the sphincters.

34. The use of each muscle in particular is confined to the motion of one or more moveable parts; some parts require a certain number of muscles to move them, whereof some act one way and some another. Several muscles, for instance, move the Os Humeri upon the scapula, and of these some raise, others depress it; some turn it forward, some backward, and others round upon its axis, &c. In like manner the forearm is moved upon the Os Humeri by certain muscles, whereof some extend and others bend it.

35. The general enumeration of the muscles of the human body which is commonly made, is founded on their supposed particular uses. We meet with lists of the muscles of the head, of the thorax, abdomen, extremities, eye, nose, lips, &c. and to the different muscles said to belong to each part, names are given, specifying some determinate use; such as *raisers*, *depressors*, *adductors*, *abductors*, *flexors*, *extensors*, &c.

36. This method of distributing and naming muscles is very well suited to the memory, and may be retained for those that are not entirely, or are not at all fixed to bones; but with respect to those muscles which are inserted in bones alone, this way of talking is very capable of misleading beginners, of begetting false ideas, of obstructing the progress of knowledge, and even of making able philosophers, physicians, and surgeons fall into considerable mistakes.

37. It leads us naturally into several errors; as for instance, that the parts to which a certain number of muscles is attributed, cannot be moved by other muscles; that the muscles

said

said to belong to one part can move no other part; that the muscles whose uses are limited and determined by certain names, can have no other uses; and that the muscles so named may have the uses assigned to them in all the different situations of the parts to which they are fixed. It is however absolutely necessary for the sake of memory, to divide the muscles into classes, and afterwards to subdivide each of these classes.

38. To shun the inconveniencies already mentioned in the muscles fixed only to bones, I discard the names taken from the parts to which these muscles are commonly attributed, and from the uses assigned to them: I retain as much as is possible the usual names which express only the insertions or other circumstances, that I may avoid all affectation of novelty; and when I find myself obliged to change a name, I set down the common name, after that which has appeared to me to be more natural and agreeable.

39. Thus, for instance, instead of this title, *The muscles of the arm*, I put the following: *The muscles that move the Os Humeri upon the scapula, and the scapula upon the Os Humeri*; and having described those which are commonly mentioned, I add the rest which may likewise move the part; and point out the uses which the muscles described may have, in moving other parts.

40. On this plan it will be necessary to describe separately all the muscles which are wholly inserted in bones, and not to explain their uses till they have all been described, they being so nearly related to one another, that it is very difficult to speak of the uses of any one, without mentioning several others.

41. When several concur nearly in the same motions, they are termed *congeneres*; those which act in opposite directions, are relatively and alternately called *antagonists*. Thus all the muscles which extend or bend the fore-arm are *congeneres*; and those which extend it are *antagonists* to the flexors; and these again reciprocally *antagonists* to the extensors.

42. There must at least be two muscles to entitle them to the name of *congeneres*, but that of *antagonist* may be given to one muscle as well as to several. Many muscles contribute to the same motion without being *congeneres*, viz. where, by acting in an oblique direction, they produce a
third

third motion which is direct and determinate. This is termed a *combined motion*, and may be successively continued in different directions, as that of the arm in turning a sling, or the handle of any heavy machine. Lastly, when all the antagonists on every side, or all the muscles that move a part, act equally and keep the part fixed in a middle direction between all the motions of which it is capable, they are said to be in a tonic motion.

43. To move any part, or to keep it in a determinate situation, all the muscles belonging to it must co-operate, some of them drawing the part directly to the situation or attitude designed, some moderating this first motion by acting in a contrary direction, and others directing it laterally. The first kind of these muscles I call *principal movers*, the second *moderators*, and the third *directors*.

44. All these kinds are to be found in the articulations by enarthrosis, and in many of those by arthrodia. The director muscles are wanting in those by ginglymus, being there unnecessary. The moderators in general are the same with those termed *antagonists*, and the want of their action is in many cases supplied by the weight of the part to which they are fixed, or by the additional weight or resistance of some other body.

45. The action of the muscles in general, or, to speak more properly, the mechanism of this action, consists chiefly in the contraction or shortening of their fleshy portion; by which the extremities of the muscle are brought nearer to each other, and consequently the parts are moved to which these extremities are fixed. It is, I say, the fleshy portion alone which is shortened; the tendons always retain the same length, and only follow the motions of the other part, much in the same manner as in drawing a great weight by ropes fixed to it, where the arm alone is shortened, while the ropes only follow that motion.

46. The principal phenomena of muscular actions are these: The fleshy portion appears harder and more swelled in the time of action than of inaction, as may be readily perceived by touching it in both states: the hardness of this swelling increases in proportion as the motion is continued, as is likewise evident by the touch; and it likewise increases by merely

*Muscular
action.*

merely adding to the weight or resistance of the part moved, though its situation does not continue to be changed.

47. In many muscles, this action may be determined to any degree of velocity and space; that is, may be proportioned to the velocity and space of the motion; may be increased and diminished, accelerated, retarded, or stopped; and may be made to cease in an instant, and be produced again in another instant.

48. During the contraction of a muscle, its fibres are bent through their whole length, or formed into very small fine folds in alternately opposite directions, as may be plainly seen in animals fresh killed, when the butchers cut their flesh while it remains warm, though the blood has been let-out, and the entrails removed. By opening living animals, and also in great wounds, the fleshy fibres have been discovered to grow pale during their action, and to turn red again when at rest.

49. To these phenomena we must likewise add, that where several muscles are fixed to any moveable part, they are all in a state of contraction, in every motion of that part; but they are not all in the same degree of action, because the principal movers act more than the moderators and directors, or collateral muscles, if any belong to the part. This co-operation of muscles is easily perceived by touching them, when the part they belong to is moved with a considerable force. It must however be remembered, that I except the moderators or antagonists when any weight or assistance supplies their action.

50. Lastly, there are some motions to which the muscles, commonly believed to produce them, contribute nothing at all, but which depend solely on the relaxation of the antagonists to these muscles, or those that lie on the opposite side. This is seen evidently in supporting the body by one hand resting on a low table, the joint of the elbow being in that state suffered to yield to the weight of the body, or to bend sometimes slowly and sometimes fast; for if at the same time we feel with the other hand the flexor and extensor muscles of the fore arm, the first will be found perfectly relaxed, the latter very much contracted. Thus it is evident that some muscles may be relaxed to determinate degrees of velocity and space, with the same certainty as they can be contracted.

51. The

51. This last phenomenon gave me room to conclude, that the action of the muscles in general consists as really in the relaxation of the moving fibres when contracted, as in the contraction of them when relaxed, whether this action be performed successively or instantaneously; and it was for this reason that when I began to speak of the action of the muscles, I did not say absolutely that it consisted in the contraction of the fleshy portion, but only that it was principally owing thereto. I do not here speak of those motions that are out of our power, and which we can determine only in part, as those of respiration, or not at all, as that of the heart.

52. The particular mechanism, or immediate cause of muscular action has very much tortured the brains of many philosophers. The extreme delicacy of the texture of a moving fibre, and a great number of phenomena, some of them very obvious, which have not been attended to, have hitherto prevented the discovery of this mystery. Several hypotheses have been formed concerning the structure of this fibre, which, as already said, has been supposed spongy, vascular, vesicular, contorted, elastic, &c. and concerning the concurrence of different fluids with the supposed structure of the fibre; and systems have even been founded wholly on the spring or elasticity of the solid parts of which a muscle is composed.

53. But by considering attentively the phenomena already mentioned, especially the first three concerning the velocity, space, and duration of muscular action, all these systems may be destroyed. For hitherto no instance can be found either in natural effects or in those of art, of any explosion, fermentation, ebullition, injection, inflation, imbibition, vibration, elasticity, &c. by which we can regulate and determine to a given degree, the space, velocity, and duration of any artificial motion, or by which we can begin and put an end to such motion in an instant of time at our pleasure. It is therefore altogether to no purpose to amuse ourselves with what has been said on this subject: another method must be followed, which consists in collecting and examining all the phenomena that can fall under our observation.

54. Till some such lucky discovery is made, what can hitherto

herto with the greatest certainty be gathered from the structure, conformation, and action of the muscles, is, that their strength depends on the number of their fleshy fibres, and the extent of their action on the length of these fibres.

55. For where-ever strength is more necessary than large degrees of motion, there we find the fibres of muscles proportionably increased in number, and that their situation in a narrow compass is artfully provided for by the oblique disposition of them already mentioned. In like manner, where-ever there is more occasion for a large degree of motion than for strength, the fleshy fibres are of a proportionable length. In a word, the strength of a muscle is as the number of its fleshy fibres, and the extent of its motion as the length of these fibres.

56. To understand the uses and contrivance of each muscle in particular, we must consider attentively its place or situation in general, its external conformation, insertions, particular situation, direction, lateral connection, relation, and composition of its parts. We ought likewise to examine how the neighbouring muscles are disposed for producing simple motions, and how those that are at a greater distance can produce combined or compound motions.

57. It ought moreover to be observed, that in some subjects the muscles vary, some being wanting, and others added in different manners, so that we ought to regulate ourselves by what happens most frequently and universally, that we may not render the common cases obscure for the sake of a few that are extraordinary, and which ought to be considered in the same light as we do the instances of six fingers, eleven ribs, and other varieties of the like kind.

58. Muscles fixed only to bones act as so many powers applied to levers. By a lever we understand a long inflexible body, like a rod or bar, by the help of which we raise weights and overcome resistances, which it would be more difficult or impossible to do with the hands alone.

59. A lever, in order to act, is applied to three different things, at three different places of its length, viz. at one place to the weight or resisting body, at a second to the power by which it acts, and at a third to a fulcrum, which, with respect to the other two, ought to be immoveable; so that the whole length of the lever is as it were divided by three

points, which may be termed *the fixed point, point of resistance, and point of power.*

60. These three points may be disposed in three different manners. 1. The fixed point may lie between the power and the weight; as when the stone-cutters and pavers raise or move stones with iron crows. 2. The weight may lie between the power and the fulcrum, as when masons move large stones by applying crows to them some where near their middle. 3. The power may lie between the weight and fulcrum, as when brasiers scrape copper in order to tin it, by laying one end of the scraper on their shoulder, the other on the metal, and holding the middle in their hands.

61. From these three dispositions three different kinds of levers have been established. In the first the fulcrum or fixed point is in the middle; in the second the weight, and in the third the power.

62. In the action of levers the following maxims are to be observed as so many general rules.

63. The greater the distance of the line of direction of the power from the fulcrum, less force is necessary to overcome the resistance.

64. The nearer that this line of direction is to the fulcrum, more force is necessary to overcome the resistance or to raise the weight.

65. When the line of direction of the power passes through the fixed point, and consequently falls in with the direction of the lever, the power can produce no effect.

A R T. II.

The Muscles of the Abdomen.

Number and situation in general.

66. **B**Y the muscles of the abdomen or lower belly we mean those which form principally the sides or circumference of that cavity. They are commonly ten in number, five on each side; eight whereof are very large, the other two very small.

Division, figure.

67. Of these muscles two are long, called *musculi recti*, two small, called *pyramidales*; six broad, two of which are named *obliqui externi*, two *obliqui interni*, and two *transversales*. The *pyramidales* are wanting

ing in some subjects, sometimes there is but one, and sometimes three. The name of these two muscles has been taken from their figure, those of the other eight, from the principal direction of their fibres.

68. These ten muscles lie in pairs, and those of each side appear to be separated by a kind of tendinous line or band running along the anterior part of the abdomen, from the cartilago ensiformis to the symphysis of the *Ossa Pubis*, and including the umbilicus; above which it is pretty broad, but narrower below, especially near the *Ossa Pubis*.

69. This tendinous band is named *linea alba*, and, as we shall see afterwards, is wholly formed by the intertexture of the tendons of the six broad muscles. *Linea alba.*

70. I shall here describe only the five muscles of one side, the other five being exactly like these; and the same method will be observed through the whole of this treatise.

§ I. *Obliquus Externus.*

71. The *obliquus externus* is a broad thin muscle, fleshy on its upper and back part, and tendinous on the anterior and greatest portion of the lower part. It reaches from half the lateral and inferior part of the thorax, to almost half the lateral and superior part of the pelvis; and from the back part of the *regio lumbaris* to the *linea alba*. *Figure and situation in general.*

72. It is fixed by its upper part, to the ribs, by the lower, to the *Os Ilium*, *ligamentum Fallopii*, and *Os Pubis*, and by the fore part to the *linea alba*. The posterior portion next the *vertebræ* of the loins has commonly no true muscular intertions. *Insertions.*

73. In the first place, it is fixed to eight ribs (seldom to nine), that is, from the fifth true rib to the last of the false, by the same number of angles of its fleshy portion in the following manner. It adheres to the external labia of the lower edges of the two or three last true ribs, and of the four following false ribs, at their bony extremities; to the extremity of the cartilage of the last false rib; to the external labium of the lower edge of that rib, and a little to the broad ligament which connects it to the transverse apophysis of the first *vertebræ* of the loins.

74. The insertions in the bony extremities of the ribs are at different distances from the cartilages in this order: in the seventh true rib the insertion is very near the cartilage, in the sixth at a little more distance; in the fifth the distance is about an inch; in the first false rib, two inches; in the second and third three inches; in the fourth, about two inches, and sometimes less; in the fifth the insertion reaches, and in a manner surrounds the cartilage.

75. The name of *digitations* or *indentations* has been given to these angular insertions, because they join a like number of the same kind belonging to other muscles, as the fingers of the two hands are locked between each other. Three or four of these digitations belong to the serratus major; and the same number to the latissimus dorsi. The three or four lowest digitations join likewise those of the serratus posterior inferior, which are covered by the extremities of the latissimus dorsi.

76. Though these digitations appear to be wholly fleshy, they are almost all a little tendinous towards the back part. They seem to increase in breadth as they descend, and often unite more or less with the intercostal muscles in their passage over them. Sometimes they communicate likewise with the pectoral muscle, the serratus major and latissimus dorsi, by distinct fasciculi of fleshy fibres, which are true reciprocal continuations of these muscles.

77. There are likewise other internal insertions covered and hid by those which appear outwardly, and which belong to the ribs lying immediately below those to which the outward digitations are fixed. Thus the digitation fixed in the last true rib sends off a fasciculus to the first false rib, as it runs up on the fore side thereof.

78. The first digitation, or that belonging to the fifth true rib, appears longer than the rest, and is about the breadth of two fingers, having communicating fibres with the pectoralis major. The second, or that of the sixth true rib, is about an inch in breadth, and unites a little with one digitation of the serratus major. The third, or that of the seventh true rib, is about three fingers in breadth, and runs for a small space toward the cartilage on the outside of the rib. The fourth, or that of the first false rib, mixes by some of its anterior fibres with those of the serratus major. The fifth, or that of the second

second false rib, mixes both with the foregoing and with the first digitation of the latissimus dorsi, and runs for some space on the surface of the rib. The sixth, or that of the third false rib, is about two fingers in breadth, and sends off a fasciculus of fibres to the serratus major. The seventh is of the same breadth with the former, and some of its fibres are continued to the serratus posterius inferior. The eighth, or that belonging to the lowest false rib, has been already described.

79. From these insertions in the ribs, the fibres of this muscle run down obliquely from behind forward. Those which come from the three lowest ribs are less oblique than the rest, appearing to form a distinct portion which continues fleshy all the way to the external labium of the crista Ossis Ilium, in which it is inserted from the posterior part of the tuberosity of that crista, to the anterior and superior spine. This insertion is by very short tendinous fibres through one half of the crista; through the other half they are longer, and some of them communicate with the fascia lata of the thigh. The posterior part of this portion seems to me to consist of a double plane.

80. The other portion of this muscle, though not altogether separated from the former, runs more obliquely; and, after some space, its fleshy fibres degenerate into a strong broad aponeurosis or thin tendon; the extremities of the fleshy fibres from the fifth true rib to the anterior spine of the Os Ilium, forming a line, which till it reaches as low as the umbilicus, is straight, and from thence downward, is incurvated backward. One portion of the tendinous plane runs down to the anterior and superior spine of the Os Ilium, where it unites a little with the superior tendon of the musculus sartorius, and afterwards is continued to the spine of the Os Pubis, being by its lower edge firmly united to the ligamentum Falloppii, and adhering closely to the fascia lata.

81. This aponeurosis grows firmer and thicker in its progress toward the Os Pubis, and in old age becomes hard and dry; for which reason hernia's are most troublesome in old people. A little before it reaches the Os Pubis, it is divided into two portions, one superior or anterior, the other inferior or posterior, between which a fissure or opening is left of a particular kind.

82. The

82. The superior or anterior portion runs obliquely downward toward the spine of the Os Pubis, crosses over the fore-side of the symphysis, and is inserted in the lower broad part of the Os Pubis on the other side. As it passes the symphysis, it crosses the like portion of the other external oblique, and their fibres decussate each other,

83. The inferior or posterior portion running more downward ends in the middle part of the symphysis, some small part of it being continued to the Os Pubis on the other side.

84. Near their extremities these two portions approach, so that the opening formed by them is in some measure oval, but narrower below than above. Through this opening the spermatic vessels pass in men, and the round ligaments in women, but in them the opening is much lower than in males. It is about two fingers breadth in length, and about half a finger in breadth at its upper part; and there it is strengthened by several tendinous fibres detached obliquely from each side, which form a sort of roundish border, from whence these openings got the name of *rings*. These collateral fibres hardly appear in children.

85. The inferior or posterior portion sends off a particular expansion to the fascia lata, which having formed a covering for the inguinal glands, is afterwards lost in the fat.

86. The remaining part of the tendon of the external oblique is fixed by oblique fibres in the linea alba through its whole length, mixing with those that come from the same muscle on the other side. These tendinous fibres are likewise continued a great way beyond the linea alba through the tendon of the other muscle, and this intertexture is reciprocal. Those who look upon the fleshy part of this muscle as its beginning, call it *obliquus descendens*, and it has likewise been named *obliquus superior* and *obliquus major*.

§ 2. *Obliquus Internus.*

87. The internal oblique is a broad thin muscle like the former, having nearly the same extent and insertions, that is, in the lower ribs above; in the crista of the Os Ilium, and ligamentum Falloppii, below; and in the linea alba, before: but it differs

*Figure and
situation in
general.*

fers from it in this, that its lower part is more fleshy than the upper.

88. One portion of its lower extremity, which is entirely fleshy, is fixed by very short tendinous fibres in the middle space between the two labia of the crista *Insertions.* Ossis Ilium, from the back part of the tuberosity of that crista near the symphysis of the Os Sacrum, almost all the way to the superior and anterior spine of the Os Ilium; so that its insertion reaches further back than that of the external oblique.

89. The fleshy fibres thus fixed, run up first a little obliquely from behind forward, and then this obliquity increases proportionably as the fibres lie more anteriorly, and they cross those of the fleshy portion of the external obliquely, being afterwards inserted exteriorly in the lower edges of the cartilages of all the false ribs, and those of the two lowest true ribs, reaching to the extremity of the cartilago ensiformis.

90. These insertions form fleshy digitations at the extremity of the lowest false rib, at the bony extremity of the fourth, and through all its cartilage, and at the middle portion of the cartilage of the third. Here the insertions become tendinous, and an aponeurosis is formed, which from the second false rib anteriorly, is divided into two laminæ by which the musculus rectus is inclosed.

91. The other portion of the lower extremity of this muscle, continuous with the former, is fixed to the anterior extremity of the crista of the Os Ilium, to its anterior and superior spine, and to that part of the ligamentum Falloppii which lies nearest it. From all this insertion, the fibres expand like radii through the whole extent of the linea alba. Those from the crista run toward the upper part of the linea alba, and afterwards they gradually change their direction, till at length they become almost perpendicular to that line. Those that come from the spine and ligamentum Falloppii, are gradually bent downward, and are inserted partly in the spine, partly in the symphysis of the Os Pubis, being inseparably mixed with the lower edge of the aponeurosis of the external oblique.

92. This anterior or radiated portion being at its beginning wholly fleshy, becomes afterwards wholly tendinous, and, together with the tendon of the other portion, forms

an aponeurosis like that of the external oblique, the extremities of all the fleshy fibres forming an oblique line a little bent from above downward, beginning at the third false rib, and reaching to the ligamentum Fallopii.

93. The aponeurosis of the internal oblique thus formed, is afterwards divided into two laminæ, from the extremity of the second false rib, to its lower edge; and having by this division furnished a vagina to the musculus rectus and pyramidalis of the same side, the two laminæ unite again at the linea alba, being interwoven with those belonging to the muscle on the other side, and mixed with the aponeurosis of the external oblique in a very singular manner. This aponeurosis is every where closely joined to that of the external oblique, and the vaginæ of the rectus seems to be stronger above the umbilicus than below it, and near the lower extremity of the linea alba becomes so thin, that the rectus and pyramidalis may be seen through it.

94. In the passage between the anterior and superior spine of the Os Ilium, and Os Pubis, at some distance above and behind the tendinous opening or ring of the external oblique, the fleshy fibres at the lower edge of the internal oblique, leave a passage for the spermatic vessels in men, and for the vascular rope called the *round ligaments* in women. This passage is near the place where this muscle joins the aponeurosis of the former; and though it appears in some subjects to be formed by a real separation of some fleshy fibres, in others it lies between the fleshy edge of this muscle and the insertion of the obliquus externus in the ligamentum Fallopii. In this course a fasciculus of fleshy fibres is likewise detached from this muscle, which contributes to the formation of a small muscle called *cremaster*, as we shall afterwards see.

95. There is moreover a thin plane or series of fleshy fibres, between the back part of this muscle and the aponeurosis of the musculus transversalis, which covers the quadratus lumborum, and seems to be fixed by a broad aponeurosis to the ligament which goes between the last vertebra of the loins and the tubercle of the *crista Ossis Ilium*. From thence it runs obliquely upward and forward, and contracting in breadth is fixed in the extremity of the last false rib. Therefore if this series be reckoned a part of the internal oblique, this muscle must be said to be inserted not only in the *crista* of the Os Ilium,

Ilium, but also in the last vertebra of the loins, by means of the ligament already mentioned.

96. This muscle is likewise called *obliquus descendens*, for the same reason that the former is termed *ascendens*, *obliquus inferior* and *obliquus minor*, because it does not reach so high, and is not quite so large as the external oblique.

§ 3. *Musculi Recti.*

97. The recti are long narrow muscles, thicker than the obliqui. They lie near each other like two large bands, from the lower part of the Thorax to the Os Pubis, the linea alba coming between them. Their breadth diminishes, and their thickness increases gradually from above downward.

Figure and situation in general.

98. The superior extremity of each muscle is fixed to a part of the lower extremity of the sternum, to the three lowest true ribs, and to the first false rib, by the same number of digitations, of which that which is furthest from the sternum is the broadest.

Insertions.

99. The body of the muscle lies in the vagina, formed by the aponeurosis of the broad muscles of the abdomen. Externorly it is divided into several portions resembling distinct muscles placed endwise, by transverse tendons termed *anastomoses*, which commonly are all above the umbilicus, very seldom below it, and they adhere very close to the vagina.

100. These intersections are pretty irregular. They do not always penetrate the whole thickness of the muscle, and in that case they do not at all appear, or but very little, on the inner surface. Sometimes those which are seen on the outer surface do not run quite cross the whole breadth of the muscle.

101. The lower extremity of this muscle is narrower than the upper, and ends in a thin tendon fixed in the internal labium of the upper edge of the Os Pubis near the symphysis, and there it touches the tendon of the other rectus.

102. Above the umbilicus these two muscles are at some distance from each other, according to the breadth of the linea alba; but below it they come nearer, the linea alba being there narrower, and near their lower extremity that line is almost entirely hid by their thick edges.

§ 4. *Musculi Pyramidales.*

103. At the lower part of the recti we meet commonly with two small muscles, which at first sight seem to be a portion or appendix of the former. They are named *pyramidales* from their figure, and by Falloppius, *succenturiati*.

Situation in general, and figure. 104. At the lower extremity they are broad and thick, being there fixed to the upper edge of the *Ossa Pubis*, immediately before the recti. They decrease gradually in breadth and thickness as they ascend, and end by a point in the *linea alba*, a little way below the *umbilicus*.

105. They are partly inclosed within the vagina of the recti, running close by each other along the *linea alba*, to which they are fixed at different distances by oblique tendinous indentations, the uppermost of which are sometimes very long.

106. Sometimes these muscles are wanting, and then the lower extremities of the recti are thicker than usual. Sometimes there is only one *pyramidalis*; and sometimes they are not both of the same size and length. We very rarely meet with three in one subject.

§ 5. *Transversales.*

107. The transverse muscles are nearly of the same breadth with the obliques. Their name is taken from the direction of their fibres, and each of them is fixed to the ribs, above; below, to the *Os Ilium* and *ligamentum Falloppii*; before, to the *linea alba*; and behind, to the *vertebræ*.

Figure and situation in general. 108. The upper part of this muscle is fixed to the lower part of the inner surface of the cartilages of the two lowest true ribs, and of all the five false ribs, by fleshy digitations, the fibres of which run more or less transversely toward the *linea alba*, at some distance from which they become tendinous. These digitations meet, and exactly correspond with those of the diaphragm, but never mix with them in the human body.

109. The middle part is fixed to the three first *vertebræ* of

of the loins, by a double aponeurosis or two tendinous planes, one internal or anterior, the other external or posterior. The internal is inserted in the transverse apophyses, the external in the spinal apophyses and interspinal ligaments, being closely united to the tendinous expansions of the neighbouring muscles; and the external planes of both transversales appear to be continuous, their common insertion in the spinal apophyses by no means hindering them from sliding, like a girth, towards either side on the processes just mentioned.

110. The internal and external planes having inclosed in their duplicature, the musculus sacra lumbaris and quadratus lumborum, unite in one strong aponeurosis at the edges of these muscles. From this aponeurosis arises the middle and greatest part of the fleshy portion of the transversalis, which, together with the superior part, advances towards the linea alba, and at some distance from it becomes tendinous.

111. The inferior part of this muscle is fixed by an insertion wholly fleshy to the internal labium of the crista Offis Ilium, and to a great part of the ligamentum Falloppii. From thence many of its fibres run towards the linea alba, the rest to the Os Pubis, all of them becoming more or less tendinous before their insertion.

112. It is commonly said that there is a separation in the fleshy fibres of this portion behind that supposed to be in the internal oblique, for the passage of the spermatic vessels, &c. There is indeed a sort of opening, but it is so very near the internal oblique, as to make it very doubtful at first sight, whether it be formed by a separation of the fibres of the transversalis, or lies between the fleshy edges of that muscle and of the obliquus internus which after a careful examination appears to be the case.

113. This proximity makes it no easy matter for many anatomists to determine whether the fleshy fibres of which the cremaster muscle partly consists, belong entirely to the internal oblique, or whether some of them do not likewise come from the transversalis, as others do from the ligamentum Falloppii.

114. The middle part of the fleshy plane of this muscle ends in a very broad aponeurosis closely adhering to that of the obliquus internus, the vagina or duplicature of which it strengthens interiorly, as that of the outer oblique does exteriorly.

teriorly. Afterwards this aponeurosis reaches the linea alba, and joins that of the other transversalis by a particular sort of intertexture, without mixing either with the internal oblique or with the peritoneum. The whole aponeurosis of the three parts of this muscle from the fleshy fibres to the linea alba, represents a kind of crescent, and it was for this reason that the ancients have said that it terminated forward in a semilunar line.

§ 6. *Connection of the obliqui and transversales.*

115. These three muscles are not only united by their lower edges, and inserted together in the ligamentum Falloppii, but also braced by the adhesion of the fascia lata to that ligament, and by the connection of its ligamentary fibres with the tendon of the external oblique. This place is commonly called the *tendinous arch* of the muscles of the abdomen, because it appears in this shape when the fascia lata is removed. This connection is strengthened by a very thin expansion of tendinous filaments, which decussate the aponeurosis of the obliquus externus, and reaching all the way to the fissure, strengthen the upper edge thereof in the manner already said.

116. When this tendinous expansion is separated from the aponeurosis of the external oblique, in young subjects and in women the opening does not any more appear like a ring, but simply as a void space left by the separation of the tendinous fibres. This expansion seems to be formed by a continuation partly of the tendinous fibres of the obliquus externus, and partly of those of the fascia lata.

117. The two oblique muscles and the transversalis of each side, are disposed in a very singular manner with relation to their fleshy and tendinous portions; for the tendons of some of them answer to the fleshy parts of the rest. The external oblique is most tendinous in the lower part and most fleshy in the upper. The internal oblique is most tendinous in the upper part and most fleshy in the lower. The transversalis is most tendinous in the middle, and most fleshy in the upper and lower parts. By this disposition these three muscles compose nearly an uniform plane, the fleshy and tendinous fibres being equally distributed through all its parts.

118. It is commonly said that the linea alba is only the concurrence

concourse or place where these three pairs of muscles meet; but if we examine well, we find there an intertexture not easy to be unravelled. One portion of the external oblique of one side seems to be continued with a portion of the internal oblique of the opposite side, these four portions making only two digastric muscles, which cross each other obliquely. In the same manner, the two transversales, by the union of their aponeurosis form a third digastric muscle; so that we have here three broad fascie or bands very artfully crossing one another, formed indeed not by the whole muscles, but only by the middle portions of them.

119. The linea alba is perforated by a small round hole near the middle of its length; the circumference of which is formed by tendinous fibres, twisted and interwoven together in such a manner, as to produce a regular and perfectly round border. Before birth, this hole transmits the funis umbilicalis, and then it is pretty large; but in adults it is very much contracted.

§ 7. *Uses of the abdominal muscles.*

120. Of these uses, some are common to all the muscles, others peculiar to each pair, or to each muscle in particular.

121. The common uses are to sustain the viscera of the abdomen, and to counterbalance the perpetual motions of ordinary respiration, and thereby gently *Common uses.* and continually to act on the viscera; which action may be reckoned a sort of trituration, of great importance to the animal œconomy. They compress the abdomen in order to clear it of what ought to pass off by the natural outlets, to relieve the stomach by vomiting, from whatever might be hurtful to it; and lastly to drive out by violent expiration whatever may incommode the organs contained in the thorax.

122. These two kinds of motion are carefully to be distinguished. The first is purely mechanical, and in a manner passive; the other is arbitrary and really active.

123. In the first, the viscera pressed by the diaphragm in inspiration, force these muscles outward on all sides, overcoming their natural spring; but the diaphragm being relaxed in expiration, and yielding to the viscera, they recover themselves again. In the second, these muscles really act, that

that is, their fleshy fibres are contracted and shortened, and thereby they compress the viscera, especially the stomach and intestines, forcing out by the nearest passages whatever is capable of expulsion.

124. In this latter case the diaphragm acts while the abdominal muscles are in contraction, and thereby concurs in an universal compression of the belly; but in the first case it does not act, as shall be fully shewn hereafter.

125. The particular disposition of the fleshy and tendinous portions of the obliqui and transversales, renders this compression uniform, and thereby the muscles resist the force of the compressed viscera, almost equally on all sides.

126. The musculi recti serve to support the trunk of the body when inclined backward, and to bend or bring it forward again; to raise the body up when lying; and lastly, to climb. They serve, I say, to bend the trunk when inclined backward or laid down; for when we stand straight, they have no hand in bending the body forward, except we be striving to overcome some resistance. The weight of the thorax, head, and superior extremities, joined to the determinate relaxation of the posterior muscles of the back and loins, produce this effect in all other cases, as has been already mentioned in the general observations on the action of the muscles.

127. I am not as yet convinced that the recti can contribute any thing to the arbitrary compression of the abdomen, which has been already mentioned as one common use of all these muscles.

128. The pyramidales seem only to assist the action of the recti; though when we consider the oblique direction of their fibres toward the linea alba, there may be some reason to think that they compass the bladder, especially when very full of urine, as Falloppius has remarked. The lower portions of the internal obliques and transversales may perhaps contribute something to this effect; for when contracted, they form a flat tight kind of girth, by the middle of which the superior extremities of the pyramidales are kept immoveable, while their bodies, being shortened and flattened by contracting, press upon the bladder.

129. The oblique muscles are capable of acting by distinct portions. Their posterior portions have nearly the same uses on

on each side as the recti have before; that is, they serve to support the trunk on one side when it is inclined to the other; to bend the body to that side on which they lie, and to raise one side of the pelvis or one hip, while the other is well supported.

130. The superior and anterior portions of the external oblique of one side, together with the inferior portions of the internal oblique of the other side, serve to turn the thorax upon the pelvis as upon a pivot, the pelvis remaining fixed and immoveable by sitting. This motion may be termed *the rotation of the thorax on the pelvis*.

131. When we stand and turn the thorax to each side in the same manner, this motion is not at first the rotation already mentioned; for the feet remaining then fixed, the legs and thighs turn to one side, and carry the pelvis along with them; but this motion being carried as far as is possible, and the pelvis being consequently in a manner fixed, the rotation of the thorax then takes place, by means of the two opposite oblique muscles, in the manner already said.

132. When all the portions of these four muscles act together they may assist the recti in great efforts; as for instance, when with the arm or breast we push forward a very heavy body, or drag it after us.

133. The transversales seem to have no other use than that of bracing or girding the abdomen in different degrees; and this they may do either by their whole plane, or by different portions thereof, and these again may gradually succeed each other. For instance, the superior portion may contract separately, while the inferior portion is totally relaxed, as I have often observed in myself.

134. There are still other uses belonging to these muscles, but they cannot be intelligibly explained till several other muscles have been described.

A.B.H.

ART. III.

The muscles which move the bones of the shoulder upon the trunk.

135. **O**F these muscles, some are inserted in the bones of the shoulder, others move these bones on the trunk without being fixed in them.

136. The muscles which move the scapula and clavicle on the trunk by being inserted in them are commonly the six following.

- | | |
|---------------------------------------|-----------------------------|
| 1. <i>Trapezius.</i> | 4. <i>Pectoralis Minor.</i> |
| 2. <i>Rhomboides.</i> | 5. <i>Serratus Major.</i> |
| 3. <i>Angularis</i> , called commonly | 6. <i>Subclavius.</i> |
| <i>Levator Scapulae proprius.</i> | |

137. The muscles, which, without being inserted in the scapula and clavicle, move them upon the trunk, and which therefore may be reckoned assistants to the former, are two in number, both belonging to that class of muscles by which the Os Humeri is moved on the scapula, viz.

- | | |
|-----------------------------|-----------------------------|
| 1. <i>Pectoralis Major.</i> | 2. <i>Latissimus Dorsi.</i> |
|-----------------------------|-----------------------------|

138. The scapula in particular, besides its motion upon the trunk, may also be moved upon the Os Humeri, by means of some of the muscles which move the Os Humeri on the scapula, as we shall see hereafter.

139. In each class of these muscles I shall only describe those which are actually inserted in the bones belonging to it, leaving to another class the muscles which move those bones without being fixed to them. I shall in this place, for instance, explain only the six muscles first named, and refer the other two to the muscles which move the Os Humeri on the scapula.

§ 1. *Trapezius.*

140. The trapezius is a large, broad, thin, fleshy plane, situated between the occiput and lower part of the back, and from thence extending to the shoulder in the figure of a large irregular

Situation in general and figure.

lar square. From this figure the ancient Greeks took its name; and, together with the trapezius of the other side, it forms a kind of lozenge.

141. Above it is fixed in the superior transverse line of the Os Occipitis, by a thin series of fleshy fibres, reaching to the musculus occipitalis, and appearing to cover that muscle by a kind of aponeurosis. Behind, it is fixed to the five superior spinal apophyses of the neck, by means of the posterior cervical ligament, and immediately to the extremities of the two lowest spinal apophyses of the neck, and of all those of the back. *Insertions,*

142. These insertions are by small and very short tendinous fibres, except between the sixth apophysis of the neck, and the third of the back inclusively, where these fibres are something longer, and form a small aponeurosis in form of a crescent, which, with that on the other side, represents a kind of ellipsis pointed at both ends. At the lower spinal apophysis of the back, these insertions are likewise tendinous, and form a small triangular plane, which, together with that of the other side, represents a square.

143. From all these insertions, the fleshy fibres run in different directions, and terminate by one continued insertion in about one third part of the clavicle, in the posterior edge of the acromium, and through the whole superior labium of the spine of the scapula all the way to the small triangular surface in that spine, over which surface the fibres pass and slide freely, without being fixed therein.

144. The directions of all these fibres are these: the superior run obliquely downward from the occiput to the clavicle: the next to these run a little less obliquely, and together with some of the superior are fixed in the superior articular ligaments of the shoulder, and in the acromium. Here the muscle forms a kind of angle included in that formed by the acromium and extremity of the clavicle.

145. The rest of the fibres that come from the neck and those from the superior spines of the back, are fixed in the spine of the scapula, reaching within an inch of the small triangular surface, becoming gradually less oblique or more transverse as they descend.

146. Lastly, the fibres which come from all the other spinal apophyses of the back, contract like radii tending toward

a centre, and are inserted in the extremity of the spine of the scapula, passing over the small triangular space, the superior being more or less transverse, and the rest becoming gradually more and more oblique running from below upward.

147. This muscle covers immediately the spleneus or mastoideus superior, part of the complexus major, the angularis, rhomboides, and part of the latissimus dorsi. The common insertion of the two trapezii in the cervical ligament is the reason that in pulling either of them toward one side of the neck, the other will follow it a little beyond the spinal apophyses.

§ 2. *Rhomboides.*

Situation in general. 148. This muscle is a thin, broad, and obliquely square fleshy plane, situated between the basis of the scapula and the spina dorsi; and it is from its figure that it has been termed *rhomboides*.

Division and insertions. 149. It may be divided into two portions, one superior, the other inferior, which sometimes appear separate. The superior portion which seems in some subjects to be made up of two, is fixed by an insertion wholly fleshy in the two or three lowest spinal apophyses of the neck, and partly in the posterior cervical ligament. The inferior portion is fixed by a tendinous plane in the three or four uppermost spinal apophyses of the back.

150. These two portions, of which the inferior is by much the broadest, being united, are inserted in the edge of the basis scapulæ, from the small triangular space to the inferior angle, the superior portion covering a small part of the insertion of the angularis.

Particular situation. 151. This whole muscle is covered by the trapezius, and covers immediately the serratus posticus superior, being joined to each of these muscles by a filamentary or cellulous substance.

§ 3. *Angularis, vulgo levator scapulæ proprius.*

Situation in general.

152. This is a long and pretty thick muscle, about two fingers in breadth, lying above the superior

superior angle of the scapula along the posterior lateral part of the neck of that bone.

153. It is inserted above in the extremities of the transverse apophyses of the four first vertebræ of the neck, by four fleshy branches ending in short tendons; sometimes the second, sometimes the third, or both, and sometimes the fourth of these branches is wanting; these defects being made up by the largeness of the rest. *Insertions.*

154. From thence these branches run down a little obliquely, and then uniting together, they are inserted in the superior angle of the scapula, and in the edge of its basis from thence to the small triangular space, being there covered a little by the rhomboides.

155. This muscle is easily divided into two through its whole length. It is covered by the trapezius, and its insertions in the neck are sometimes mixed with those of the neighbouring muscles. *Particular situation.*

§ 4. *Pectoralis Minor.*

156. This is a small fleshy muscle, something of a triangular shape, situated at the superior, lateral, and anterior part of the thorax. *Situation in general.*

157. By its basis it is inserted in the external labium of the upper edge of the second, third, fourth, and fifth true ribs, near their union with the cartilages, by the same number of digitations or separate fleshy portions, because of the intervals between the ribs; and for that reason it has been called *serratus minor anticus*. *Insertions.*

158. From thence these portions run up more or less obliquely, toward the shoulder, and form a fleshy belly which contracts as it passes before the two first ribs, and then becoming a short, flat, and broad tendon, is inserted in the upper part of the apophysis coracoides of the scapula, reaching all the way to the point of that process.

159. This muscle is covered by the pectoralis major, and adheres very closely to the external intercostal muscles. The digitations commonly taken notice of, cover and hide several others, by which the number of fibres and thickness of this muscle are increased. *Particular situation.*

increased. Its tendon unites a little at the apex of the coracoid apophysis, with the insertion of the coraco-brachialis, and with that of one portion of the biceps.

§ 5. *Serratus Major.*

160. This is a broad, fleshy, and pretty thick muscle, lying on the lateral part of the thorax between the ribs and scapula by which it is covered. *Situation in general.* Its figure is that of an irregular square, its greatest breadth being in the back part where it terminates by digitations of unequal lengths, in a radicated disposition, their extremities describing an arch or curve; and from these digitations its name is taken.

161. It is inserted backward in the internal labium of all the basis of the scapula from the superior to the inferior angle. *Insertions.* From thence running forward wholly fleshy, it increases gradually in breadth, and is inserted in all the true ribs, and often in one or two of the false ribs, by the same number of digitations.

162. The insertion in the first true rib is about five fingers breadth from the cartilage; in the second, something less; in the third, about four fingers breadth; in the fourth, three; in the fifth, two; in the sixth, one; in the seventh, one half; and in the first false rib, two fingers breadth; but in all these measures some latitude is to be allowed. The breadth of each insertion in the ribs is at least an inch.

163. Though the digitations of this muscle give it a radiated appearance from the scapula to the ribs, yet these radii do not at all lie in that disposition which at first sight we would be apt to imagine. *Division and particular situation.* The muscle is made up of two planes, one great, the other small.

164. The small plane looks like a distinct narrow muscle, closely adhering to the superior edge of the great plane. It is fixed by one extremity under the superior angle of the scapula, and by the other to the first rib by a small insertion, and to the second rib by a broad insertion. This plane is easily seen by turning the scapula forward, having first separated the rhomboides; but when that is turned back, the pectoralis

pectoralis minor being first cut off, this plane does not appear, being covered and hid by the broad one.

165. The broad plane may be divided into two portions, one superior and one inferior, adhering to each other by their edges.

166. The superior portion is thin, and takes up about three quarters of the basis of the scapula, reckoning from the superior angle. From thence it contracts by small degrees, and forms two digitations very like those of the small plane, which they cover by their insertions in the two first true ribs, or in the second and third, and sometimes in all the three.

167. The inferior portion is fixed in the lower quarter of the basis scapulæ, from whence it expands itself by six or seven very long fleshy digitations, which decrease in breadth as they descend, and are inserted, in the manner already said, in the six or seven ribs which follow the two first. It must be observed, that the three first digitations take up almost all this quarter of the basis scapulæ, the three last being fixed precisely in the inferior angle. The extremities of the three or four lowest digitations mix fibres with those of the obliquus externus of the abdomen.

168. The direction of the fibres and digitations of the serratus major will be easily comprehended, by recollecting that the ribs are inclined downward in different degrees from behind forward; for which reason the fibres of the superior portion of the broad plane, cross over the ribs at less acute angles than those below them, so that, in the natural situation of the scapula, the lowest of these fibres which run up very obliquely, cross over the third, fourth, and fifth true ribs.

169. The upper fibres of the inferior portion of the broad plane, run up proportionably more obliquely, and therefore cross over more ribs, and at more acute angles than the others which are less oblique; and though some of them run transversely, yet the ribs being oblique, they must cross over some of them, though in a lesser degree. The lowest of these fibres or digitations run a little downward, and consequently fall in more with the direction of the ribs, but not so much as may be imagined. These digitations are very small and weak.

§ 6. *Subclavius.*

170. This is a small oblong muscle lying between the clavicle and the first rib. It is fixed by one end in all the middle lower portion of the clavicle, at the distance of about an inch from each extremity; and by the other, in the cartilage and a small part of the bone of the first rib. It seems likewise to adhere to the extremity of the clavicle next the sternum, by a kind of broad thin ligament.

A R T. IV.

The muscles which move the Os Humeri on the scapula.

171. **T**HE muscles which are inserted in the Os Humeri, and thereby move it upon the scapula, are commonly nine in number, viz.

- | | |
|-----------------------------|------------------------------|
| 1. <i>Pectoralis Major.</i> | 6. <i>Teres Major.</i> |
| 2. <i>Latissimus Dorsi.</i> | 7. <i>Teres Minor.</i> |
| 3. <i>Deltoides.</i> | 8. <i>Subscapularis.</i> |
| 4. <i>Supra-spinatus.</i> | 9. <i>Coraco-Brachialis.</i> |
| 5. <i>Infra-spinatus.</i> | |

172. The pectoralis major is inserted in the trunk and clavicle; the latissimus dorsi in the trunk and scapula; the deltoides in the two bones of the shoulder; and the other six muscles in the scapula alone.

173. Two of these nine muscles may likewise move the bones of the shoulder on the trunk; the other seven may move the scapula on the Os Humeri.

174. The muscles which without being inserted in the Os Humeri, may in some circumstances move it upon the scapula, are two in number, belonging to the class of muscles which move the bones of the fore-arm on the Os Humeri, viz.

- | | |
|--------------------|--|
| 10. <i>Biceps.</i> | 11. <i>Anconæus major</i> , commonly called
<i>extensor cubiti major.</i> |
|--------------------|--|

Both these muscles may likewise move the scapula on the Os Humeri, as shall be remarked in describing them.

§ 1. *Delt-*

§ 1. *Deltoides.*

175. This is a very thick muscle covering the upper part of the arm and forming what is termed the stump of the shoulder. It is broad above and narrow below in a triangular form; and its name is taken from the resemblance it bears to the Greek letter Δ Delta; but to make the comparison hold, either the letter or the muscle must be inverted, and the muscle flattened.

Situation in general and figure.

176. It is made up of eighteen or twenty small single muscles in an opposite situation with respect to each other, and united by middle tendons, so that taken all together they form several penniform muscles. The outer surface appears almost wholly fleshy, but on the inner surface we see the several tendons.

Structure.

177. All these small muscles are disposed in such a manner as to form a considerable extent at the upper part, from whence they contract gradually in breadth, till they end in a thick strong tendon, by which the whole muscle terminates in an angle or point.

178. Above, it is fixed in the whole inferior labium of the spina scapulae, in the convex or long edge of the acromium, and in the third part of the anterior edge of the clavicle next that apophyses. It surrounds the angle formed by the articulation of these two bones by a particular slope and fold contrived for that purpose.

Insertions.

179. From thence it runs down above one third of the length of the Os Humeri, where it is inserted by a thick tendon in the large muscular rough impression below the bony ridge which goes from the great tuberosity of the head of the bone, and forms the highest border of the groove or channel mentioned in the description of the skeleton, N^o 638.

180. This insertion seems to be immediately implanted in the substance of the bone, passing through the periosteum, which is commonly the case in all insertions in these kinds of impressions, eminencies, or considerable tuberosities. It lies below that of the pectoralis major, and a little more forward. Some of the fibres of this muscles are fixed in the aponeurosis common to all the muscles which cover the arm.

181. This muscle may be distinguished into three principal

Division. pal portions, one of which is fixed in the spine of the scapula, one in the acromium, and one in the clavicle. They are separated from each other by a small quantity of fat or cellular substance chiefly near the basis of the muscle.

182. The middle and strongest portion runs down almost directly to its insertion in the Os Humeri. The lateral portions seem to end sooner, but it is only because they turn inward toward the bone, and thereby form the biggest and thickest part of the tendon. The anterior or clavicular portion sends off some fibres to the bone, before it reaches the tendon.

183. The portion fixed in the spine of the scapula, sends backward a thin aponeurosis, which is strengthened by another tendinous or ligamentary series of fibres. This aponeurosis is fixed in the basis of the scapula below the spine, and from thence is extended toward the interior angle. The other series begins at the spine, and ends near the same angle at the beginning of the inferior costa. These, together with the great tendon, seem to contribute to the formation of the tendinous expansion which covers the muscles of the arm.

Particular situation. 184. At its upper part this muscle joins the insertion of the trapezius, and below, that of the brachialis. Anteriorly it joins the pectoralis major, being distinguished from it only by a small line of fat or of cellular substance, and a small vein called *cephalica*. It covers the head of the Os Humeri, and adheres to the capsular ligament of the joint, and it likewise covers the insertion of the pectoralis major.

§ 2. *Pectoralis Major.*

Situation in general and division. 185. This is a large, thick, and fleshy muscle, covering the fore-part of the breast, from the sternum where it is very broad, to the axilla where it contracts in its passage to the arm. It is naturally divided into two portions, one superior and small, which may be termed *clavicular*; the other inferior and large, which we may call *thoracic*.

186. The clavicular portion is fixed by a fleshy insertion in almost half the clavicle next the sternum, ending under the insertion

insertion of the sterno mastoidæus. From thence it runs obliquely down toward the axilla, contracting by small degrees, and ends in a flat tendon or tendinous band. In this passage, it borders on the anterior edge of the deltoides, from which it is distinguished only by a fatty or cellulous line, and a small vein named *vena cephalica*.

187. The thoracic portion is broad and in some measure radiated. It is fixed by its anterior circumference in the lateral part of the outside of the sternum, in the outside of the cartilages, and in a small part of the bones of all the true ribs, and of the first and sometimes the second false rib. All these insertions are like so many digitations.

188. The insertions in the sternum end by a great number of very short tendons which run toward the middle of the bone, meeting and decussating those from the same muscle on the other side. The lower insertions are most distinctly digitated, and they mix with those belonging to the rectus and obliquus externus of the abdomen, there being likewise several fasciculi of fibres common to the pectoralis with these muscles. This portion is also fixed to the ribs by internal fleshy strata covered by the external insertions, and forming, together with them, the thickness of the muscle.

189. From thence all the fleshy fibres contract in breadth and approach each other, in their passage to the arm. The superior fibres run downward, joining those of the clavicular portion; those next them run less obliquely; the following more or less transversely, and the inferior run upward, in the same manner. This whole portion ends at length in a flat tendon joined to that of the small portion, and folded back upon it in the following manner.

190. The inferior fleshy fibres of the thoracic portion, before they reach the tendon in their passage to the arm, are gradually turned inward under each other, and then run up behind the extremities of the superior fibres. By this turn, the lower part of the tendon answers to the superior fleshy fibres, the middle fibres of both to each other, and the upper part of the tendon to the lower fleshy fibres; and so on. Thus the tendons of both portions adhering closely by their flat sides, and united at their edges, form a double tendinous plane, the fibres crossing each other. The anterior or exter-

nal plane belongs to the clavicular portion; the internal or posterior plane to the thoracic portion.

191. The tendon thus formed is inserted, according to its breadth, at about one fourth part of the length of the bone from the head, in the bony ridge of the great tuberosity, that is, in the outer edge of the groove or channel, the cavity of which it lines in conjunction with another tendon, by a stratum of very thin, shining, transverse fibres. This insertion lies between that of the tendon of the deltoides which it touches, and that of the latissimus dorsi, which is on the other side of the groove.

192. This muscle, together with the deltoides, sends off an aponeurosis, which joining that of the biceps, is spread over the muscles of the arm. It partly covers the pectoralis minor and serratus major, and by its broad tendon it covers transversely the brachial channel and the tendon of the biceps lodged there. Lastly, it forms the anterior border of the hollow of the axilla, as the posterior is formed by the latissimus dorsi.

§ 3. *Latissimus Dorsi.*

193. This is a broad, thin, and mostly fleshy muscle lying between the axilla where it is very narrow, and the back on which it expands itself by radiated fibres both in length and breadth, from the middle of the back all the way to the lower part of the regio lumbaris; and from this situation it has its name.

Situation in general. 194. Its insertions, without reckoning that in the arm, are partly tendinous and partly fleshy. In the first place, it is sometimes, but not always, fixed in the inferior costa of the scapula near the angle by a fasciculus of fleshy fibres. In the next place, it is fixed by an aponeurosis, in the spinal apophyses of the six or seven, and sometimes eight lowest vertebræ of the back, in those of all the vertebræ of the loins, in the superior spines and lateral parts of the Os Sacrum, and in the external labium of the posterior part of the Os Ilium.

195. Besides all this tendinous course, it is inserted by fleshy digitations in the last four false ribs. These digitations cover those of the serratus inferior posticus, and mix with those

those of the obliquus externus abdominis, there being sometimes fasciculi of fibres common to both muscles. It is not always fixed to the lowest false rib; and sometimes that insertion is by a particular kind of aponeurosis which is pretty strong. I have likewise seen it fixed to the first false rib by a very small thin digitation.

196. From all these insertions the fibres of this muscle tend in different directions to the arm. At the middle of the back they are almost transverse, and they become more and more oblique as they descend. Towards the region of the loins their obliquity decreases again, and on the ribs they are almost longitudinal. As they run up they contract in breadth, and under the axilla they terminate in a flat tendon, turned almost in the same manner as that of the pectoralis major, but more simply, and without any adhesion between the two planes. The upper edge of this flat tendon is turned inward, answering to the lower or lateral part of the muscle, and the lower edge which hides the other by crossing a little over it, answers to the upper or posterior part of the muscle.

197. The tendon thus formed is fixed in the Os Humeri a little below the small superior tuberosity, in the inner edge of the bony groove or channel, the cavity of which it also lines by a transverse smooth expansion, nearly as is done by the tendon of the pectoralis major from the other edge, so that these two tendons meeting by their extremities in the groove, appear in some measure to be continued with each other; I say, in some measure, because the tendon of this muscle is not so broad as that of the pectoralis major.

198. The tendon of the latissimus dorsi is accompanied by another flat tendon belonging to the teres major; *Connection.* but it is inserted higher up than that other tendon and nearer the channel, so that the lower edge of the tendon of the latissimus dorsi may be said to encroach on the upper edge of the other tendon. These two tendons communicate by some collateral fibres, and are both strengthened by the same ligamentary frænum, which runs down from the insertion of the subscapularis below that of the teres major, in describing which muscle, I shall have occasion again to mention this frænum.

199. This muscle is covered by the trapezius, from the

*Particular
situation.*

sixth to the last vertebra of the back, and covers the serratus inferior posticus. Its aponeurosis is at first narrow, but increases in breadth as it descends between the vertebræ and Os Ilium. It adheres strongly to that of the serratus inferior posticus, and still more to the transversalis, sacro-lumbaris, and longissimus dorsi. This muscle, together with the pectoralis major, forms the cavity of the axilla.

§ 3. *Teres Major.*

200. This is a long, thick, flat muscle, situated a little obliquely between the inferior angle of the scapula, and the upper part of the arm. This muscle and the teres minor are called *round*, though they are considerably broader than they are thick; because they come much nearer to that figure, than any other muscle which moves the Os Humeri on the scapula.

Situation in general. 201. It is fixed by its posterior fleshy extremity in all the large angular surface on the outside of the scapula, in the inferior costa of that bone and near the angle. From thence it advances with longitudinal fibres toward the upper quarter of the Os Humeri, terminating in a broad flat tendon intermixed with some fleshy fibres, which at the upper edge are continued all the way to the insertion, lying in the same place with the tendon.

Insertions. 202. It is inserted by its anterior extremity at the lower part of the bony ridge of the small tuberosity, along the edge of the channel, almost opposite to, and sometimes a little lower than the insertion of the pectoralis major. It lines the cavity of the channel by a tendinous elongation, which joins that from the pectoralis, and seems to be continued with it. This insertion is below that of the latissimus dorsi, with which it communicates by a small aponeurosis.

203. The tendons of these two muscles, the teres major and latissimus dorsi, lie almost in the same plane, as has been already observed, the upper edge of the first running up a little way on one side the lower edge of the latter, and the two edges crossing each other in a small degree. The tendon of the latissimus dorsi lies behind, and covers that of the teres major.

204. These

204. These two tendons near their insertions have a ligamentary frænum belonging to them, which runs down from the insertion of the subscapularis, and is inserted below that of the teres major. It covers the two tendons, and keeps them close to the bone.

§ 5. *Teres Minor.*

205. This is a very fleshy muscle, resembling the teres major, but narrower and shorter. It lies above the last-named muscle, between the costa inferior of the scapula and the head of the Os Humeri.

Situation in general.

206. It is fixed by one end to all the middle part of the inferior costa of the scapula, and to the long particular surface immediately above that costa, reaching from the great angular surface near the neck of the bone. From thence it runs wholly fleshy, till it changes into a flat tendon which is inserted in the posterior or inferior surface of the great tuberosity of the head of the bone, and likewise a little lower down.

Insertions.

207. It adheres very close to the lower edge of the infra-spinatus, and the tendons of these two muscles are united; for which reason the ancients confounded them together, and did not look upon this as a particular muscle. It is covered by the deltoides.

Connection.

§ 6. *Infra-spinatus.*

208. This is a triangular, fleshy, and pretty broad muscle, in some measure penniform, filling the whole infra-spinal cavity or fossa of the scapula.

Situation in general.

209. It is fixed in the posterior half of the infra-spinal cavity or fossa, and to the corresponding part of the basis of the scapula.

Insertions.

210. From thence arise a great number of short fleshy fibres, which run more or less obliquely, and end in a middle tendinous plane, which terminates a little below the broadest part of the spine of the scapula, under the root of the acromium.

211. Then the fleshy fibres leaving the bone, unite in one fleshy

fleshy mass, which passing under the acromium over the articulation of the head of the Os Humeri, and adhering to the capsular ligament, terminates there in a flat broad tendon, which adhering likewise to the capsula, is afterwards inserted in the greater middle surface of the great tuberosity of the head of the Os Humeri. At the place where the fibres leave the infra-spinal fossa under the acromium, there is a great quantity of fat or adipose cells, between the bone and the loose portion of the fleshy mass.

212. This muscle appears double a little below the spine and toward the basis of the scapula, because of
Connection. the middle tendinous plane already mentioned. It seems likewise to be confounded with the teres minor, to which it is very closely joined. Its tendon is united on one side with that of the teres major, and on the other with that of the supra spinatus, and it is covered by the posterior portion of the deltoides.

§ 7. *Supra-spinatus.*

Situation in general. 213. This is a thick narrow muscle, in some measure penniform, filling all the supra-spinal cavity of the scapula.

214. It is fixed to all the posterior half of the supra-spinal fossa, and sometimes its insertion reaches near the neck of the bone. There the fibres leave the surface of the bone, and being, as it were, supported by the fat or cellulous substance, pass between the acromium and neck of the scapula, under the arch formed by the acromium and extremity of the clavicle, and under the ligament between the acromium and apophysis coracoides; being afterwards inserted in the superior surface of the great tuberosity of the head of the Os Humeri, very near the bony channel. This muscle is covered by the trapezius.

§ 8. *Coraco-brachialis.*

Situation in general. 215. This is a long muscle lying on the inside of the upper half of the Os Humeri, that is, on that side which answers directly to the hemisphere

sphere of the head of the bone, and to the prominent internal condyle.

216. It is fixed above to the point of the coracoide apophysis, between the insertions of the biceps and pectoralis minor, by a tendon, which, as it descends, adheres for a good way to the tendons of these two muscles. Afterwards it becomes fleshy, and is inserted by a broad thin extremity with a small mixture of tendinous fibres, in the middle part of the Os Humeri, close by the ligamentary frænum of the latissimus dorsi and teres major. Its insertion is continued down below the frænum near the internal intermuscular ligament, to which it likewise adheres a little.

Insertions.

217. This muscle passes behind the tendon of the pectoralis major; and as it is perforated in the middle to give passage to a nerve, it has by some been termed *perforatus Casserii*, that author being the first who gave a particular figure of it. The other name is taken from its insertions.

Particular situation.

§ 9. *Subscapularis.*

218. This muscle is of the same breadth and length with the scapula, of which it occupies all the inner or concave side, and from this situation it has its name. It is thick, and made up of several peniniform portions nearly in the same manner with the deltoides.

Situation in general.

219. It is fixed in the internal labium of the whole basis, and in almost the whole internal surface of the scapula; its fleshy portions lying in the intervals between the bony lines, when these are found. Near the neck they leave the bone, and form a very broad tendon which is inserted in the surface of the small tuberosity of the head of the Os Humeri, close by the bony channel. The lower edge of this tendon probably sends off the ligamentary frænum mentioned in the description of the latissimus dorsi, teres major, and coraco-brachialis.

Insertions.

220. This muscle covers immediately the serratus major, being in a manner inclosed between it and the scapula. The upper edge of its tendon is joined to the lower edge of that

Particular situation and connection.

of

of the supra-spinatus, except at the upper part of the bony channel where they give passage to one tendon of the biceps. It likewise adheres to the capsular ligament. The tendons of the supra-spinatus, infra-spinatus, teres minor, and subscapularis, being all joined by their edges, form a sort of cap which covers the upper part of the head of the Os Humeri.

A R T. V.

The Muscles which move the bones of the fore-arm on the Os Humeri.

221. **T**Hese muscles are commonly reckoned six in number; two flexors lying on the foreside of the arm, called *biceps* and *brachieus internus*; and four extensors situated on the backside, named *extensor longus*, *extensor brevis*, *brachieus externus*, and *anconæus*. The terms of *brachieus* and *extensor brevis* are now become so indeterminate, as to be often taken for one another; as likewise those of *biceps externus* and *brachieus externus*, which the moderns have substituted in the room of the former.

222. Of the two anterior muscles, I name one simply *brachieus* with the ancients, the other *biceps* or *coraco-radialis*; and I call all the four posterior muscles *anconæi*, distinguishing them afterwards by the epithets of *major*, *minor*, *externus*, *internus*. These four muscles might be reduced to two, the *anconæus* and *triceps*; which last may again be distinguished into *major*, *longus* or *medius*, *externus* and *internus*.

223. The disposition and names of these muscles, according to what has been said, are these;

- | | |
|---|---|
| 1. <i>Biceps sive Coraco-radialis.</i> | 4. <i>Anconæus Externus.</i> |
| 2. <i>Brachieus</i> , called commonly <i>Brachieus Internus.</i> | 5. <i>Anconæus Internus.</i> |
| 3. <i>Anconæus Major</i> , called also <i>Extensor Cubiti Longus.</i> | 6. <i>Anconæus Minor</i> , called simply <i>Anconæus.</i> |

Sometimes the *anconæus externus*, and sometimes the *internus* is called *extensor cubiti brevis*, or *brachieus externus*.

224. These muscles move not only the fore-arm on the Os Humeri, but also the Os Humeri on the fore-arm; neither

are they all confined to these two motions alone; for the biceps or coraco-radialis and anconæus major may move the Os Humeri on the scapula, and the scapula on the Os Humeri. The biceps by its insertion in the radius performs likewise the motion of supination, and that with much more force than the muscles commonly assigned for that action by the name of *supinatores*.

225. The motions of the fore-arm on the Os Humeri are not all performed by these six muscles alone. The *supinator longus*, as it is termed, assists therein, as has been already observed by Heister; and indeed it seems better fitted for that motion than for supination, as we shall afterwards see; and for that reason I rank it among the auxiliary muscles which move the fore-arm on the Os Humeri, &c. by the name of *radialis longus*.

§ 1. *Biceps sive Coraco-radialis.*

226. This is a double muscle made up of two long fleshy bodies, more or less round, lying by the side of each other, on the middle anterior part, and a little toward the inside of the arm. These two bodies are separated above, each of them ending in a small tendon. As they run down they become contiguous, and afterwards closely united by one common broad tendon. The ancients, who looked upon the two superior extremities as two heads, gave this muscle the name of *biceps*, and from its insertions I call it *coraco-radialis*.

Situation and conformation.

227. It is fixed by one of the superior tendons, in the apex of the coracoid apophysis of the scapula, on one side of the tendon of the coraco-brachialis, which adheres very strongly to it. This tendon of the biceps is broader, shorter, and situated more internally than the other; the fleshy body belonging to this tendon is longest, and consequently runs highest up.

Insertions.

228. The other superior tendon is smaller and longer than the former, and the fleshy body belonging to it, shorter and more compounded. This tendon is lodged in the bony channel of the Os Humeri, being surrounded by a membranous vagina continued from the capsular ligament, and ending at the fleshy body where it is entirely closed.

229. At the upper part of the groove, the tendon runs between the insertions of the tendons of the supra-spinatus and subscapularis; passes immediately over the head of the bone within the capsular ligament; then leaving the joint between the two tendons just mentioned, is covered by another short vagina, and is inserted above the glenoid cavity, in the superior impression of the neck of the scapula, near the basis of the coracoid apophysis.

230. The two fleshy bodies thus separately fixed by their superior tendons approach by degrees as they descend, and before they reach the middle of the Os Humeri are closely united, forming afterwards a common tendon of a considerable breadth, which is inserted laterally in the posterior edge of the tuberosity at the neck of the radius.

231. This inferior or common tendon of the biceps, a little before its insertion, sends off towards the internal condyle, an aponeurosis, which increasing obliquely in breadth on the same side, covers the inner and back parts of almost the whole fore-arm, especially the muscles which lie upon the ulna, where it is insensibly lost. It likewise strongly adheres to the muscles named *pronator teres* and *radialis internus* on the fore-side of the joint of the elbow.

232. Both the fleshy bodies of the biceps contribute to the formation of this aponeurosis, each of the two portions of which the common tendon is made up, furnishing a series of tendinous fibres, which, covering the fore-side of the true tendon, unite near the internal condyle by a particular kind of intertexture, and thus produce the aponeurosis.

§ 2. *Brachialis.*

233. This is an oblong, thick, and broad muscle, lying immediately on the anterior part of the lower half of the Os Humeri. The upper part of it is forked or sloped, and at the bending of the joint of the elbow, the lower part contracts.

234. It is fixed to the surface of the Os Humeri by a great number of fleshy fibres, from the lower insertion of the deltoides, almost down to the two fossæ at the lower extremity of the bone, and from one edge of the fore-side of this lower extremity to the other. The fibres are

for the most part longitudinal, those nearest the surface of the muscle being longest, the more internal growing gradually shorter.

235. The lateral fibres are a little oblique, and this obliquity increases in those that lie lowest. These lateral fibres are partly fixed in the intermuscular ligaments of the Os Humeri, of which ligaments, that which lies toward the internal condyle is longer and broader than that toward the external condyle. The lowest of these fibres are very oblique, and form on each side a kind of small separate fasciculus.

236. In passing over the joint all these fibres contract in breadth, and afterwards end in a strong flat tendon inserted in the muscular impression, which is directly below the coronoid apophysis of the ulna. This muscle adheres very strongly to the capsular ligament, and some of its fleshy fibres terminate therein.

237. The sloped or forked superior extremity of this muscle embraces the large tendon of the deltoides. The internal point of the fork meets the inferior insertion of the coraco-brachialis; and the fore-side of the whole muscle is covered by the two fleshy bodies of the biceps. *Connection.*

§ 3. *Anconæus Major.*

238. This is a long fleshy muscle lying on the backside of the Os Humeri. *Situation in general.*

239. It is fixed above by a short tendon to the inferior impression in the neck of the scapula, and to a small part of the inferior costa of that bone. From thence it passes between the extremities of the subscapularis and teres minor, and having reached the backside of the lower extremity of the Os Humeri, it ends obliquely in a strong broad tendon, which adhering closely to the capsular ligament, is afterwards fixed by a broad insertion in the rough tuberosity on the upper side of the olecranon. *Insertions.*

240. It lies between the two lateral anconæi, and, by its adhesions to them, a triceps muscle is formed, of which this is the middle portion, I call all these three muscles *anconæi*, because of their insertions in the olecranon or ancon. *Connection.*

§ 4. *Anconæus Externus.**Situation
in general.*

241. This is a long muscle lying on the outer part of the backside of the Os Humeri, from its neck to the external condyle.

*Insertions and
connection.*

242. It is fixed above in the neck of the Os Humeri under the inferior surface of the great tuberosity, and under the insertion of the teres minor, but a little more backward. It runs down by the anconæus major, adhering strongly to the bone, except at that oblique depression, on account of which this bone appears contorted, as was said in the treatise of the skeleton. It is likewise fixed by some oblique fibres in the external intermuscular ligament.

243. From all this space the fleshy fibres contract in breadth, being joined more or less obliquely to the outer edge of the tendon of the anconæus major, all the way to the olecranon. The termination of these two muscles in the common tendon, forms a very acute angle, and represents a sort of penniform muscle.

§ 5. *Anconæus Internus.**Situation in
general.*

244. This muscle is shorter and more fleshy than the anconæus externus, and lies toward the inner part of the lower half of the Os Humeri.

*Insertions and
connection.*

245. It is fixed above, under the lower extremity of the teres major, but a little more backward, and to the internal intermuscular ligament, which makes a kind of septum between this muscle and the brachialis. From thence the fibres contracting in breadth, pass toward the tendon of the anconæus major, some of them running in between it and the bone, and are inserted in the edge and inner side of that tendon.

§ 6. *Anconæus Minor.**Situation in
general.*

246. This is a small muscle obliquely triangular, lying in the oblong fossula on the outside of the olecranon.

247. It

247. It is fixed by a small but pretty strong tendon, in the lower part of the external condyle of the Os Humeri. From thence the fleshy fibres run down obliquely in a radiated form, and are inserted in the bottom and whole posterior edge of the fossula already mentioned. *Insertions.*

248. It is closely united to, and in some subjects seems to communicate by several fibres with the muscle termed *ulnaris externus*; and its tendon adheres very strongly to that of the *anconæus externus*. Some anatomists having confounded this muscle with the *ulnaris externus*, have been seen to raise them together, looking afterwards in vain for the *anconæus minor*; which however is very easily distinguished from the other by a fatty or cellulous line. *Connection.*

A R T. VI.

The muscles which move the radius upon the ulna.

249. **T**Hese muscles are reckoned to be four in number, viz.

1. *Supinator Longus sive Major.* 3. *Pronator Teres.*
2. *Supinator Brevis sive Minor.* 4. *Pronator Quadratus.*

250. These muscles cannot move the radius on the ulna without moving it at the same time on the Os Humeri; but the radius may be moved on the Os Humeri without being moved on the ulna, and consequently without the assistance of the muscles commonly assigned to the radius.

251. I have already observed that the *supinator longus* does not belong more particularly to the radius than to the ulna; and that it is much better fitted for bending the forearm than for the supination of the radius, as shall be further shewn in describing the uses of the muscles.

252. There are some cases in which these muscles cannot perform the motions either of supination or of pronation, without the assistance of those that move the fore-arm on the Os Humeri, and even of some that move the Os Humeri on the scapula, as shall be shewn in speaking of the uses of muscles.

§ 1. *Supinator Longus five Major.**Situation in
general*

253. This is a long flat muscle lying on the external condyle of the Os Humeri, and on the convex side of the radius from one end to the other.

*Insertions and
connection.*

254. It is fixed by fleshy fibres to the external intermuscular ligament, and to the crista of the external condyle of the Os Humeri, for five or six fingers breadth above the condyle; between the brachæus and anconæus externus. From thence it runs along the whole convex side of the radius, and is inserted by a flat narrow tendon, a little above the styloide apophysis in the angle between the concave and flat sides of the extremity of this bone.

§ 2. *Supinator Brevis five Minor.**Situation in
general.*

255. This is a small thin fleshy muscle, surrounding a great portion of the upper third part of the radius.

*Insertions and
connection.*

256. It is fixed by one end to the lower part of the external condyle of the Os Humeri to the external lateral ligament of the joint, to the annular ligament of the radius, and to part of the lateral eminence in the head of the ulna.

257. From thence it passes obliquely over the head of the radius, covering some part of it, and running down upon, and in some measure surrounding the neck, it turns in under the bicipital tuberosity, and is inserted by the side of the interosseous ligament in the inside of the superior quarter of the bone, and even a little lower. In some subjects we may observe the marks of the passage of this muscle over the outside of the bone. It makes an angle with the pronator teres, resembling the Roman V.

§ 3. *Pronator Teres five Obliquus.**Situation in
general.*

258. This is a small muscle, broader than it is thick, situated on the upper part of the ulna opposite to the supinator brevis, with which it forms an angle like the letter V.

259. It

259. It is fixed to the internal condyle of the Os Humeri, partly by fleshy fibres, and partly by a tendon common to it with the ulnaris internus. From thence *Infections.* it passes obliquely before the extremity of the tendon of the brachialis, and reaches to the middle part of the convex side of the radius, where it becomes flat, and is inserted below the supinator brevis by an extremity almost wholly fleshy.

260. It is called *teres* to distinguish it from the quadratus. The name of pronator superior would be more proper, but that of pronator obliquus is the most proper of all.

§ 4. *Pronator Quadratus sive Transversus.*

261. This is a small fleshy muscle nearly as broad as it is long, lying transversely on the inside of the lower extremity of the fore-arm. *Situation in general.*

262. It is fixed by one side or edge in the long eminence at the lower part of the internal angle of the ulna, and by the other in the broad concave side of the lower extremity of the radius. *Infections.*

263. It is wholly fleshy, without any mixture of tendinous fibres. It is situated transversely, but that extremity which lies on the radius is nearer the carpus than that on the ulna. It is of a moderate thickness; and the fibres nearest the surface are the longest, the rest decreasing in proportion as they lie near the interval between the two bones and the interosseous ligament.

264. It has a ligamentary or tendinous frænum belonging to it, one end of which is fixed in the interosseous ligament, the other in the inner edge of the basis of the radius.

A R T. VII.

The muscles which move the carpus upon the fore-arm.

265. **T**HE muscles that immediately perform the motions of the carpus on the fore-arm, are six in number, viz.

- | | |
|---------------------------------|--|
| 1. <i>Ulnaris Internus</i> | muscles, whereof one may be termed |
| 2. <i>Radialis Internus.</i> | <i>Radialis Externus primus</i> , the other |
| 3. <i>Ulnaris Externus.</i> | <i>Radialis Externus secundus.</i> |
| 4. 5. <i>Radialis Externus,</i> | 6. <i>Ulnaris Gracilis</i> , called commonly |
| which is really two | <i>Palmaris Longus.</i> |

They

They have the names of *ulnaris* and *radialis* from their situation, being all situated along the ulna and radius.

266. These muscles may likewise move the fore-arm on the carpus, and, in some cases, they cannot without assistance perform the motions attributed to them.

267. The auxiliary muscles which assist in moving the carpus on the fore-arm, belong to the class of those that move the fingers, as we shall see hereafter.

§ 1. *Ulnaris Internus.*

Situation in general.

268. This is a long muscle, fleshy at its upper extremity and tendinous at the other, situated on the outer part of the ulna.

Insertions and connection.

269. It is fixed by its upper part on the backside of the long or internal condyle of the Os Humeri, in that part of the olecranon which is next the condyle, along the upper half of the ulna very nearly; and to the middle common tendon of the neighbouring muscle, termed commonly *profundus*.

270. It runs in the direction of the external angle of the ulna, and ends by a long tendon, in the Os Pisiforme or Orbiculare of the carpus, reaching likewise to the Os Unciforme, being united to the ligament common to these two bones.

§ 2. *Radialis Internus.*

Situation in general.

271. This is a long muscle very like the foregoing, but situated more obliquely.

Insertions and connection.

172. Its fleshy portion is fixed by a short tendon, to the outer and upper side of the inner condyle of the Os Humeri. From thence it passes obliquely toward the radius, and running along about two thirds of that bone, it forms a long tendon which continues in the same course, and at the lower extremity of the radius, passes under a particular annular ligament, and under the insertion of the musculus thenar.

273. This tendon is at length inserted chiefly in the inside of the basis of the first metacarpal bone, and often in the second likewise, and a little in the first phalanx of the thumb, having

having first passed through the channel of the Os Trapezium, which sustains the thumb.

§ 3. *Ulnaris Externus.*

274. This is a long muscle lying on the outside of the fore-arm, fleshy toward the Os Humeri and tendinous toward the carpus.

Situation in general.

275. It is fixed above to the external condyle of the Os Humeri, being there united to the anconæus minor; to the annular ligament of the head of the radius, and to the upper half of the external angle of the ulna. From thence it advances and forms a tendon, which passes through the external notch at the lower extremity of this bone, on one side of the styloide apophysis.

Insertions.

276. The tendon having afterward passed under a particular ligament situated near the Os Cuneiforme of the carpus, is inserted in the outside of the basis of the fourth metacarpal bone, sending some tendinous filaments to the basis of the little finger. It is likewise often fixed in the basis of the third metacarpal bone.

§ 4. *Radialis Externus Primus & Secundus.*

277. These are two muscles closely united together, appearing at first sight like one muscle lying along the external angle of the radius, between the Os Humeri and the carpus, being fleshy near the former and tendinous near the latter.

Situation in general.

278. In many subjects we find these two muscles entirely distinct from one end to the other; and they may be named *radialis externus primus* & *radialis externus secundus*, regard being had to the insertion of their tendons. Sometimes the two fleshy portions adhere closely together, appearing to make but one body, but the tendons are always distinct and separate.

Division.

279. The first is inserted above, in the crista of the external condyle of the Os Humeri, below the insertion of the supinator longus. The second is inserted in the same condyle below the insertion of the first; and in the neighbouring articular ligament. From thence the two fleshy

Insertions.

bodies run down very close together, and having reached the middle of the outside of the radius, each of them terminates in a long tendon.

280. The two tendons accompany each other to the extremity of the radius, and having passed under a particular annular ligament, they are divided as it were into two cornua, from whence the ancients, who looked upon them as one muscle, gave it the name of *bicornis*.

281. One of these tendons is inserted anteriorly in the basis of the first metacarpal bone, the other nearly in the same place of the second bone, which is the reason why I chose to distinguish them by the names of *primus* and *secundus*. The tendon of the first is sometimes double, appearing like another *bicornis*.

§ 5. *Ulnaris Gracilis, vulgo Palmaris Longus.*

Situation in general.

282. This is a small muscle lying between the Os Humeri and the carpus on the inside of the fore-arm, its body being small and slender, its tendon very long and flat.

Insertions.

283. It is fixed by its fleshy portion, in the small crista of the inner condyle of the Os Humeri, sometimes closely united to the ulnaris internus. From thence it runs down fleshy for some space, turning a little obliquely towards the middle of the fore-arm, and ends in a long, narrow, thin tendon.

284. This tendon passes down the middle of the fore-arm, over all the other muscles to which it slightly adheres, and advancing over the large internal annular or transverse ligament of the carpus, is inserted in the surface thereof, sending off some radiated filaments to the aponeurosis palmaris.

285. I have found this muscle fixed to the condyle of the Os Humeri by a tendon about a finger's breadth in length, to which the fleshy body was joined toward the middle of the fore-arm.

286. I have likewise seen the inferior tendon inserted in the Os Scaphoides of the carpus, without communicating with the large annular ligament; and I have seen the aponeurosis palmaris arise from this ligament; from all which it may reasonably

reasonably be concluded, that that aponeurosis has no essential dependance on this muscle.

287. Sometimes this muscle appears to be only a production from the ulnaris internus.

§ 6. *Palmaris Cutaneus.*

288. This muscle, commonly known by the name of *palmaris brevis*, does not belong to this place, where my design is to mention no muscles but those which are solely fixed in bones. But as it is usually ranked among the muscles belonging to the upper extremity; and consequently the description of it would never be looked for any where else, I have chosen to insert it here.

289. It is a small thin plane of fleshy fibres situated transversely, or more or less obliquely under the skin of the large eminence in the palm of the hand, between the carpus and the little finger; its fibres adhering to the skin, and being in some measure interwoven with the *membrana adiposa*.

290. These fibres are fixed along the edge of the aponeurosis palmaris from the large ligament of the carpus toward the little finger; and they run in for some space on the plane of the aponeurosis, but without any connection with the bones of the metacarpus. Near the aponeurosis these fibres are more or less tendinous, and some of them often cross each other. They are sometimes so thin and pale, as hardly to be sensible; and in some subjects this muscle seems to be divided into several parts.

A R T. VIII.

The muscles which move the bones of the metacarpus.

291. **T**Here is one muscle which very visibly moves the fourth metacarpal bone on the *Os Unciforme* of the carpus, and thereby draws the third metacarpal bone along with it. This muscle, which may be termed *metacarpus*, has been always hitherto looked upon as a portion of a muscle belonging to the little finger.

292. The metacarpal bones are likewise moved on the car-

pus by the ulnares and radiales, and by all the muscles in general that go to the fingers, as by so many auxiliaries.

293. The number of metacarpal muscles would be increased, were the first phalanx of the thumb looked upon as a metacarpal bone.

Metacarpus.

Situation in general.

294. This is a small very fleshy muscle, situated obliquely between the large internal annular or transverse ligament of the carpus, and the whole inside of the fourth metacarpal bone.

Insertions. 295. It is fixed by a small short tendon to the Os Orbiculare, and to the neighbouring part of the large ligament of the carpus. From thence its fibres run more or less obliquely toward the inside of the fourth metacarpal bone, in the outer edge of which they are inserted. The fibres of this muscle are of unequal lengths, and extend all the way to the articulation of the first phalanx of the little finger with the fourth metacarpal bone, but they have no manner of relation to that finger.

A R T. IX.

The muscles which move the fingers.

296. **T**Hese muscles may be divided into those which move the thumb, and those which move the other four fingers. Both these may again be divided into large or long, and small or short muscles. The distinction of these muscles into common and proper is not suitable, because these two terms are afterwards used as the proper names of some particular muscles which move the four fingers.

297. I said in the beginning of this treatise, that for muscles solely fixed in bones, I would make use of no names taken from the functions attributed to them. However, as the greatest part of the muscles of the fingers and toes have proper names, and only a few of them are called flexors or extensors, these names may still be retained, provided they be looked upon only as proper names, as shall be said at more length hereafter.

298. The

298. The muscles belonging to this article are these:

- | | |
|--|---|
| 1. <i>Flexor Pollicis Longus.</i> | 9. <i>Extensor Indicis Proprius.</i> |
| 2. <i>Extensor Pollicis Longus.</i> | 10. <i>Extensor Minimi Digiti Proprius.</i> |
| 3. <i>Thenar.</i> | 11. <i>Lumbricales.</i> |
| 4. <i>Mesothenar.</i> | 12. <i>Interossei.</i> |
| 5. <i>Antithenar.</i> | 13. <i>Semi-interosseus Indicis.</i> |
| 6. <i>Perforatus.</i> | 14. <i>Hypothenar Parvus.</i> |
| 7. <i>Perforans.</i> | |
| 8. <i>Extensor Digitorum communis.</i> | |

§ 1. *Flexor Pollicis Longus.*

299. This is a long muscle, fixed by short and oblique fleshy fibres to the inside of the upper part of the interosseous ligament near the radius, and along that bone all the way down to the pronator quadratus. There it terminates in a flat tendon, which is insensibly formed from the very beginning of its superior insertion, by all the fleshy fibres of which the muscle is made up.

Situation and insertion.

300. This tendon having passed under a particular ligament, runs in between the two portions of the thenar, and then into a sort of groove left between the two sesamoid bones fixed to the basis of the second phalanx of the thumb, on that side which is turned to the palm of the hand. Afterwards the tendon ends in the flat side of the third phalanx near its basis. It is inclosed in a ligamentary vagina from the annular ligament to its insertion, and it is divided or slit, so that it appears to be inserted by two extremities adhering together by their edges.

§ 2. *Extensores Pollicis.*

301. These are two very distinct muscles, the first or longest of which is sometimes more, sometimes less, and sometimes altogether divided into two, in which case these muscles are three in number. They are situated obliquely between the ulna and convex side of the thumb.

Division and situation in general.

302. The extensor primus is a long muscle, more or less double

double in the manner already said. It is fixed above by fleshy fibres, first to the outside of the ulna near its upper extremity, below the anconæus minor and insertion of the ulnaris externus: next to the interosseous ligament under the supinator brevis; and lastly, to the middle part of the outside of the radius.

303. From thence it runs down and passes anteriorly over the lower part of the radius and tendons of the supinator longus and radialis externus, and being gradually divided, it terminates in two long flat tendons, more or less subdivided, which pass together under a particular annular ligament, being only parted by septa or fræna belonging to that ligament.

304. The first of these two principal tendons is inserted in the edge of the basis of the first phalanx, near the large transverse ligament of the carpus. When this tendon is subdivided, the other portion of it is fixed in that bone of the carpus which sustains the thumb. The other principal tendon, which often belongs to a muscle entirely distinct from the former, is fixed in the convex side of the basis of the second phalanx, where it joins the tendon of the extensor secundus. On account of these different insertions of the two tendons, this muscle is by some authors described as two.

305. The extensor secundus is shorter than the first. It is fixed to the ulna below the former, and above the insertion of the extensor indicis proprius, and likewise to the neighbouring part of the interosseous ligament. From thence it runs down obliquely on the middle part of the radius, where it has likewise a small adhesion. Afterwards it passes through the small channel in the styloide apophysis of the radius, through the annular ligament belonging to the tendons of the radialis externus, and over these tendons, being parted from them by a small ligamentary septum. It is inserted in the convex part of the third phalanx near its basis, having as it passes over the second phalanx, joined the second or collateral tendon of the first extensor, more or less.

§ 3. *Thenar.*

306. This is a very thick fleshy muscle in some measure pyriform, lying on the first phalanx of the thumb toward the palm of the hand, the large eminence in

Situation in general.

in which is chiefly formed by it. Its name is taken from a Greek word which signifies to *strike*.

307. It is fixed to the bone which supports the thumb, and to the neighbouring part of the great internal annular or transverse ligament of the carpus. It is in some measure bicipital, two distinct portions answering to the two insertions already mentioned. As it runs along the first phalanx these two portions unite, and diminishing in thickness, are both inserted by one tendon in the lateral internal part of the head of the first phalanx, in the lateral part of the basis of the second, and in the lateral ligament of that joint.

308. The void space between the two portions of this muscle gives passage to the tendon of the flexor pollicis longus. That portion which lies nearest the hollow of the hand, is the largest, and its tendinous extremity is inserted in the first sesmoide bone situated at the basis of the second phalanx.

§ 4. *Mesothenar.*

309. This is a flat and nearly triangular muscle lying between the first phalanx of the thumb, and the bottom of the palm of the hand. *Situation in general*

310. It is inserted by a very broad basis in the ligament which connects the Os Magnum of the carpus to that which supports the thumb. It is likewise *Insertions.* inserted along the internal or angular part of that bone of the metacarpus, which supports the middle finger, and in the small extremity of that which answers to the index.

311. From thence the fibres contracting to an angle, terminate in a flat tendon of different breadths, which is inserted in that side of the head of the first phalanx of the thumb, which is turned to the hollow of the hand, and in the neighbouring part of the basis of the second phalanx, by means of the second sesmoide bone belonging to that joint.

§ 5. *Antithenar sive Semi-Interosseus Pollicis.*

312. This is a small flat fleshy muscle situated obliquely, between the first phalanx of the thumb, and first bone of the metacarpus. *Situation in general.*

313. It is fixed by one end toward the basis of the first metacarpal

Insertions. metacarpal bone, near the first bone of the second row of the carpus. From thence it runs obliquely toward the head of the first phalanx of the thumb, and is inserted in the lateral external part of that bone, or on that side which is turned to the first metacarpal bone. It crosses over the semi-interosseous indicis, this muscle lying toward the back of the hand, and the antithenar toward the palm.

§ 6. *Perforatus vulgo sublimis.*

314. This is a muscle of a considerable volume lying along the inside of the fore-arm, fleshy for the greatest part near the articulation of the fore-arm with the Os Humeri, and near the carpus terminating in four distinct portions, which become the same number of long small tendons. The name of *sublimis* has been given to it, because it lies almost on the surface of the fore-arm; and that of *perforatus* from the flits found near the extremities of its tendons.

Situation in general. 315. It is commonly made up of four muscles closely united by their fleshy portions representing there one large body of muscles. It is fixed above to the superior internal parts of the ulna and radius, (this last bone being considered in its natural situation), and to that of the interosseous ligament. A little below the middle of the fore-arm, this large fleshy body is divided into four distinct muscles, which, on the lowest quarter of the fore-arm, end in four flat tendons of different sizes.

Division and insertions. 316. These four tendons are inclosed in a common membranous or mucilaginous vagina, which likewise furnishes each tendon with a particular thin vagina. In this manner they advance to the carpus, and pass under the large annular transverse ligament. Beyond this ligament they spread again in the palm of the hand, still retaining their particular vaginæ, and run between the aponeurosis palmaris and metacarpus toward the fingers, separating more and more by degrees. Sometimes there are at first only three tendons, one of them being afterwards divided into two, in their passage to the fingers; sometimes they communicate by a kind of detachment, with the tendons of the perforans.

317. Ha-

317. Having reached the heads of the metacarpal bones, they pass under the four arches or fræna formed by the furcæ of the aponeurosis palmaris, and particular septa of the great transverse ligament of the palm of the hand; and then each tendon having got beyond the head of one metacarpal bone, and beyond the basis of the first phalanx, enters the ligamentary vagina on the flat or inner side of that phalanx, and is inserted in the flat side of the second phalanx near its basis, the membranous vagina accompanying it to its insertion. The ligamentary vagina is stronger towards the basis than toward the head of the first phalanx.

318. In passing along the inside of the first phalanx, the tendon is divided by a long slit which gives passage to a tendon of the perforans, and from thence the names of these two muscles are taken.

319. This fissure or opening is contrived in a very singular manner; the tendon is first of all divided in two flat portions, and each portion is contorted on the flat side of the phalanx; so that the edges which were nearest become opposite, and the opposite edges are joined together all the way to the extremity of the tendon. By this contorsion the fissure seems to form two small oblique grooves, which surround the tendon in opposite directions, one groove being covered by the tendon, and the other covering it.

320. This is not all: The two portions having formed this double groove by their mutual contorsion, are not united, only by simply approaching each other at their extremities; for each portion is at that place again divided into two others, smaller and shorter than the former; so that in all there are four narrow portions; the two nearest of which cross each other, and join the other two; so that from the four narrow ones are formed two broad portions anew, which are joined by their edges, and afterwards inserted in the bone at a small distance from each other.

§ 7. *Perforans vulgo Profundus.*

321. This muscle is very like the former, and it is situated much in the same manner, only it lies lower, and is covered by the perforatus. It

Situation in general and division.

is composed of four muscles, which at first seem to make but one mass, and afterwards terminate in four tendons.

Insertions. 322. The fleshy portions of the first and largest, and also of the second, are fixed in the superior parts of the ulna and interosseous ligament down to their middle; the fleshy portion of the third is joined to the tendon of the ulnaris internus by a sort of common aponeurosis, and that of the fourth is fixed along the ulna.

323. The four tendons have often several small collateral tendons, sometimes five in number, united to the tendons of the neighbouring muscle, as they pass under the large annular ligament of the carpus; but the tendons themselves are separated from the others by thin septa, which form a kind of particular rings. Being thus strengthened they separate, and running along the palm of the hand in distinct membranous vaginae, like those of the perforatus by which they are covered, they enter the ligamentary vaginae of the first phalanges together with the former; and having passed through the fissures thereof and through the ligamentary vaginae of the second phalanges, they are inserted in the flat inner side of the third near their basis.

324. The ligamentary vaginae of the second phalanges appear sometimes stronger near the basis than near the heads of the bones.

§ 8. *Extensor Digitorum Communis.*

Situation in general.

325. This is a compound muscle very much resembling the perforatus and perforans, lying on the outside of the fore-arm between the ulnaris externus and radialis externus.

Insertions and division.

326. It is fixed above by a tendinous extremity, to the posterior and lower part of the external or great condyle of the Os Humeri, and by a tendinous adhesion on each side, to the ulnaris and radialis externus. It has likewise sometimes a small insertion in the radius. It is divided into four muscles like the perforatus and perforans, and four long slender small tendons.

327. Three of these tendons pass through the common external annular ligament of the carpus; and the fourth, which goes to the little finger, and which has sometimes its fleshy portion

portion distinct from the rest, passes through a particular ring of the same ligament.

328. Afterwards these four tendons separate as they go to the fingers, and in their passage communicate with each other by oblique tendinous series chiefly near the heads of the metacarpal bones. The tendons of the middle and little finger are sometimes double, and yet communicate with the rest.

329. Each tendon having reached the basis of the first phalanx, is slightly inserted therein by some lateral expansions fixed in each side of the basis. From thence it advances to the head of the same phalanx, where it is divided into two flat portions, which, at the articulation of the first phalanx with the second, leave some distance between them. About the head of the second phalanx they unite again, and are fixed in the convex side of the third phalanx near its basis. The separation of the two portions is in some sort rhomboidal, and each portion is strengthened by a common tendon of the lumbricales and interossei. In the void space between them are small tendinous fræna, more or less transverse.

§ 9. *Extensor Indicis Proprius.*

330. This is a small long muscle with a long slender tendon, lying a little obliquely on the lower and outer half of the fore-arm between the ulna and fore-finger. *Situation in general.*

331. It is fixed by its fleshy body a little higher than the lowest third part of the outside of the ulna, below the insertion of the extensor pollicis, and it has likewise a small adhesion to the interosseous ligament. From thence it runs down, ending in a distinct tendon without any communications, which having passed through the annular ligament of the extensor communis, afterwards joins that tendon which goes to the index. *Insertions.*

§ 10. *Extensor Minimi Digiti Proprius.*

332. This is a kind of collateral or auxiliary muscle of the extensor communis, of which it appears almost to be more or less a portion. *Situation in general*

333. It is fixed along the superior external half of the ulna, from whence its long small tendon runs down in company with the fourth tendon of the extensor communis, all the way to the little finger, where it joins it, and is inserted with it. Sometimes this muscle is wanting, in which case the extensor communis sends a double and sometimes a triple tendon to the little finger.

§ 11. *Lumbricales.*

Situation in general. 334. These are four very small slender muscles lying in the hollow of the hand, in the same direction with the perforatus and perforans.

Insertions. 335. They are fixed by their fleshy bodies to the tendons of the perforatus on the side next the thumb, near the large annular ligament of the carpus. Near the heads of the metacarpal bones they become very thin tendons, which accompany those of the perforans through the furcæ of the aponeurosis palmaris. Then they pass on to the same sides of the first phalanges, and join the tendons of the extensor communis; each of them being connected with the nearest portion thereof, at the articulation of the first phalanx with the second.

336. These tendons are likewise united to some of the interossei, and their insertions seem to vary in different subjects; for though they lie generally on that side of the fingers which is next the thumb, yet, if I am not mistaken, I have observed the first inserted in the index on the side next the thumb, the second and third on each side the middle finger, and the fourth in that side of the ring-finger which is farthest from the thumb.

§ 12. *Interossei.*

Situation in general and division. 337. These are small muscles lying between the metacarpal bones, and filling the three interstices left between them, both exteriorly or toward the back of the hand, and interiorly or toward the palm of the hand. From this situation they have the name of *interossei*, and have been divided into external and internal. They are commonly reckoned six in number, three

three external and three internal, regard being had only to the fleshy masses in the metacarpus, and to the six tendinous insertions in the fingers; but if we consider the composition of these masses, their number may be increased.

338. The external interossei are stronger, more compound, and take up more space between the metacarpal bones than the internal. Each of them is made up of two portions, one of which appears almost on a level with the bones, the other hid, and which runs in upon the internal muscles.

339. The apparent portion is in some measure penniform, being fixed along the sides of two bones, and also by a small extremity to the nearest bone of the carpus. The other portion which lies hid appears more simple, and seems to be fixed only to the bases of the same two bones.

340. Near the heads of the metacarpal bones, these two portions of each muscle end in broad flat tendons, which having reached the side of the first phalanx of one finger, are afterwards united with the nearest portion of the tendon of the extensor communis. One portion is likewise inserted in the phalanx itself, by small short tendons. These muscles may therefore be reckoned bicipital, especially when the tendons of the two portions unite.

341. The first two external interossei are for the most part inserted in the middle finger. They fill the interstices between the three first metacarpal bones, and surround the middle bone all the way to the hollow of the hand. Their tendons are fixed in both sides of the first phalanx, and in both sides of the second tendon of the extensor communis.

342. The third external interosseus lies in the interstice betwixt the two last metacarpal bones, and is most commonly inserted in the ring-finger; its tendon being fixed in that side of the first phalanx farthest from the thumb, and in the corresponding edge of the third tendon of the extensor communis. The fleshy body of this muscle runs in between the two bones toward the hollow of the hand.

343. The internal interossei are more simple than the former, and do not lie so much between the bones. The tendon of the first is inserted in the side of the first phalanx of the fore-finger, next the little finger, and in the corresponding edge of the extensor communis. The tendon of the second goes in the same manner to the side of the ring-finger

finger next the thumb; and the third to the same side of the little finger.

344. There are therefore two external interossei for the middle finger, one for the ring-finger, but none for the fore and little finger. The middle finger has no internal interosseous; but the index, ring-finger, and little finger, have each of them one.

345. The external interossei appear sometimes to be really double, the two muscles being separated by a fatty line; so that in some subjects we have six internal interossei. But the fleshy portions on each side of the second metacarpal bone belong to the two first external muscles; and the fleshy portion on the side of the fourth metacarpal bone next the thumb, belongs to the third external interosseus, according to the disposition in which I have described them.

§ 13. *Semi-interosseus Indicis.*

Situation in general.

346. This is a small, short, flat, fleshy muscle, very like the antithenar or internal semi-interosseous of the thumb. It is situated obliquely on one side of that of the thumb, between the first phalanx thereof, and first metacarpal bone.

Insertions. 347. It is fixed by one end to the outside of the basis of the first phalanx of the thumb, and a little to that bone of the carpus by which this phalanx is supported; and by the other end it is fixed near the head of the first phalanx of the index, on that side next the thumb. It lies almost parallel to the antithenar, crossing over it a little; this muscle lying on the convex side of the hand, and the antithener on the concave side.

§ 14. *Hypothenar Minimi Digiti.*

Situation in general.

348. This is a small and pretty long muscle lying on the back side of the fourth metacarpal bone opposite to the thumb, where, together with the metacarpus or hypothenar metacarpus, it forms that large eminence over-against the thenar, or that of the thumb. It may be called *hypothenar minor*, and that of the metacarpus, *hypothenar major*.

349. It is fixed by one end to the Os Orbiculare of the carpus,

pus, and a little to the neighbouring part of the large annular ligament. The other end terminates by a short flattish tendon fixed to that side of the basis of the first phalanx of the little finger which is turned from the thumb. This muscle covers the metacarpus a little, and they have both been looked upon as portions of one hypothenar.

Insertions.

A R T. X.

The Muscles which move the Os Femoris upon the Pelvis.

350. **T**HESE muscles are commonly twenty-two in number, sixteen of which are inserted in the Os Femoris, and six move it without being fixed to it.

351. These muscles only which are inserted in the Os Femoris are reckoned to belong to the thigh, and they are commonly said to be fourteen in number, but it is easy to make out sixteen very distinct from each other. Of these sixteen three lie on the fore and upper part of the thigh, viz.

1. *Psoas.*
2. *Iliacus.*
3. *Pectineus.*

352. On the inside of the thigh are three, commonly reckoned one, by the name of *triceps*, though, according to the ancient language, it has three tails, as well as three heads and three bellies; and therefore might more properly be called *triplex*.

4. *Triceps sive Triplex Primus.*
5. *Triceps Secundus.*
6. *Triceps Tertius.*

353. Three form the buttocks, and are called,

7. *Glutæus Maximus.*
8. *Glutæus Medius.*
9. *Glutæus Minimus.*

354. There are six very small muscles, more or less hid under the glutæi, the four first of which are by some termed *quadrigemini*. The particular names of these six are:

10. *Pyriformis.*
11. *Gemellus Superior.*
12. *Gemellus Inferior.*
13. *Quadratus.*
14. *Obturator Externus.*
15. *Obturator Internus.*

355. Lastly,

355. Lastly, there is a small anterior superficial muscle, commonly but falsely termed *fascia lata*, which is a large membranous, tendinous, or ligamentary covering, to which the greatest part of this small muscle is fixed; and therefore it ought not to be called by the name of that membrane without restriction, that is, without the addition of *musculus* in this manner:

16. *Musculus Fasciæ latæ, sive Musculus Membranosus.*

356. The six muscles which move the Os Femoris without being inserted in it, belong to the class of those which move the leg upon the thigh, viz.

17. *Sartorius.*

20. *Semi-membranosus.*

18. *Rectus Gracilis.*

21. *Semi nervosus.*

19. *Rectus sive Gracilis internus.*

22. *Portio Bicipitis longa.*

357. All these muscles, whether inserted or not inserted in the Os Femoris, not only move that bone on the pelvis, but may also move the pelvis on the Os Femoris.

358. The fascia lata already mentioned surrounds more or less all these muscles. It is a muscular ligament *Fascia lata.* very considerable both for its extent and strength, being made up chiefly of two planes of fibres, of which the external are more or less longitudinal; the internal more or less transverse. It is further strengthened in some places by a great number of other fibres, which augment its thickness and form particular expansions. The transverse fibres are much stronger than the longitudinal.

359. It is fixed above to the edge of the crista Ossis Ilium, from the large tuberosity to the anterior superior spine; to the ligamentum Falloppii, and to the aponeurosis of the obliquus externus of the abdomen, on which it runs up by a thin lamina. It is likewise fixed in the lateral inferior part of the Os Sacrum, and to the neighbouring parts of the ligaments by which that bone is connected to the Ossa Ilium and Ischium.

360. From thence it advances over the glutæi and thigh between the membrana adiposa and muscles, all the way to the anterior and outer parts of the knee. It is very thin on the patella, but may be separated from it. It is likewise continued over the external anterior part of the tibia, covering the

the muscles which lie there, and is strongly inserted in the head and crista of that bone, and in the upper part of the fibula.

361. It sends off elongations, which, like so many septa, run in between the muscles, and sometimes meet in such a manner as to form vaginae. It is strongest on the anterior and outer parts of the thigh, growing gradually thinner on the inner and back parts.

362. It is strongly inserted in the linea femoris aspera between the vastus externus and biceps, forming a sort of septum between these muscles. It furnishes particular vaginae to the muscles which lie on the inside of the thigh; and though these vaginae are thin, they are nevertheless pretty strong, being chiefly made up of transverse fibres.

§ 1. *Psoas sive Lumbaris Internus.*

363. This is a long thick muscle situated in the abdomen on the lumbar region, adhering to the vertebræ of the loins, from the posterior part of the Os Ilium to the anterior part near the thigh.

Situation in general.

364. It is fixed above to the last vertebra of the back and to all those of the loins, that is, to the lateral parts of the bodies of these vertebræ, and to the roots of their transverse apophyses. The insertions in the bodies of the vertebræ are by a kind of digitations, and are very little tendinous.

Insertions.

365. From thence the muscle runs down laterally over the Os Ilium, on one side of the iliac muscle, and passes under the ligamentum Falloppii, between the anterior inferior spine of the Os Ilium, and that eminence, which, from its situation, may be termed *ilio-peelinea*.

366. Before it goes out of the abdomen, it unites with the iliacus, and is sometimes fixed, by a few fleshy fibres, in the outside of the eminence last mentioned. It afterwards covers the foreside of the head of the Os Femoris, and is inserted in the forepart of the little trochanter by an oblique tendon, which is folded double from behind forward.

367. This muscle is sometimes accompanied by another smaller muscle almost like it, called *psoas parvus*, which I have

ranked among the muscles of the loins, because it seldom reaches lower than the pelvis.

§ 2. *Iliacus.*

Situation in general.

368. This is a broad thick muscle lying on the whole inside of the Os Ilium.

369. It is fixed by fleshy fibres to the internal labium of the crista Ossis Ilium, to that of the slope between the two anterior spines, to the insides of these spines, to the superior half of the inside of this bone, and to the neighbouring lateral part of the Os Sacrum.

370. All these fibres contracting by degrees run obliquely towards the lower part of the musculus psoas, uniting therewith, and being fixed by a kind of aponeurosis to the outside of its tendon all the way to the little trochanter. They cover the head of the Os Femoris, and some of the lowest are inserted in that bone a little above and behind the little trochanter, and others a little lower down.

371. On the outside of the lower extremity of the iliacus, there is sometimes a small separate muscle fixed immediately under the anterior inferior spine of the Os Ilium, from whence it runs obliquely downward, joins the iliacus, and is inserted below the little trochanter. It represents, in some measure, a Roman V, with the pectineus, and might be reckoned an iliacus minor, if the large muscle had not sometimes an insertion in the side of the eminence called *ilio-pectinea*.

372. The iliacus and psoas thus united pass under the ligamentum Falloppii, over the slope or channel between the anterior inferior spine of the Os Ilium and *eminentia ilio-pectinea*, in a sort of ligamentary capsula very smooth and polished, that part of it which covers the channel appearing like a cartilage.

§ 3. *Pectineus.*

Situation in general.

273. This is a small flat and pretty long muscle, broad at the upper part and narrow at the lower, situated obliquely between the Os Pubis and upper part of the Os Femoris. It is commonly a single muscle; but I have sometimes found it double.

274. It

374. It is fixed above by fleshy fibres to all the sharp ridge or crista of the Os Pubis, and to a small part of the oblong notch or depression on the foreside of that crista, in which the upper extremity of this muscle is lodged. *Insertions.*

375. From thence it runs down obliquely towards the little trochanter, under and a little behind which, it is inserted obliquely by a flat tendon, between the superior insertion of the vastus internus and inferior insertion of the triceps secundus with which it is united.

§ 4. *Gluteus Maximus.*

376. This is a thick broad muscle, resembling the quadrant of a circle in figure, lying on the outside of the Os Ilium and upper part of the Os Femoris.

Situation in general.

377. It is fixed wholly fleshy to all the lateral posterior parts of the Os Coccygis and Os Sacrum; to the ligamentum sacro-sciaticum; to the outside of the tuberosity of the Os Ilium; and from thence to the external labium of the crista of that bone all the way to its highest part where this muscle mixes fibres with the glutæus medius. *Insertions.*

378. It is likewise fixed to the inside of the fascia lata, at the places which answer to all the insertions already mentioned, but through a much greater space, and by a very great number of fleshy fibres, almost in the same manner as we shall see in the external plane of the musculus temporalis. The fibres which end in this fascia become gradually shorter, as they are situated lower.

379. All these fibres contract in breadth in a radiated manner as they approach to the great trochanter, and afterwards form a strong, flat, pretty broad tendon, about an inch in length, which is inserted a finger's breadth or a little more below the great trochanter, in all that large longitudinal impression at the upper part of the linea aspera on the backside of the Os Femoris, between the vastus externus and largest portion of the triceps.

380. This tendon is covered and strengthened by a production of the fascia lata, in which several fleshy fibres of this muscle are inserted at that place. It is a very strong tendon,

don, and in this and other respects bears some resemblance to that of the deltoides.

Connection. 381. This muscle covers part of the glutæus medius; and at its insertion in the Os Coccygis, it almost joins that of the glutæus maximus of the other side.

§ 5. *Glutæus Medius.*

382. This is a radiated muscle almost in the shape of a spread fan. It is pretty thick, and almost as broad as the whole outside of the Os Ilium, being situated between the crista of that bone and the great trochanter, and covered anteriorly by the fascia lata, and posteriorly by the glutæus maximus.

Situation in general. 383. It is fixed above by fleshy fibres to all that space on the outside of the Os Ilium, which lies between the external labium of the crista, and the semicircular impression which goes between the superior and anterior spine, and the great posterior sinus.

384. It is likewise fixed in the edge of that ligament which goes between the lower part of the Os Sacrum and Os Ilium. Lastly, the inner part of it which is covered only by the fascia lata, is inserted in the inside of that fascia, in the same manner as the glutæus maximus.

385. From thence all the fibres contract in breadth, more or less in a radiated manner, as they advance toward the great trochanter, and form a short thick tendon which mixes a little anteriorly with the tendon of the glutæus minimus; and the most posterior fibres gradually join the side of the tendon of the pyriformis.

386. The tendon is inserted in the upper convex part of the great trochanter, from the apex of the large superior external rough surface, all the way to the anterior rough surface, encompassing in a manner all that part of the trochanter.

387. This is the broadest of all the glutæi. The disposition of its fibres is not every where uniform; the anterior series seeming to make a distinct portion, not by being separated from the rest, but by being differently directed, for they descend almost parallel to each other; whereas the middle and posterior portions are in a more radiated

diated disposition; and the anterior portion is likewise more fleshy and thick than the other two.

388. When this muscle is inverted upward, its tendon being first cut off from its insertion, we see a kind of tendinous arch running along its whole insertion in the semicircular line.

§ 6. *Gluteus Minimus.*

389. This is a small, broad, radiated muscle, situated on the outside of the Os Ilium, under the other two glutæi. *Situation in general.*

390. It is fixed above in all that portion of the outside of the Os Ilium, which lies between the great semicircular line, and another small one a little above the supercilium of the cotyloide cavity or acetabulum, running between the anterior inferior spine and the great posterior sinus. It is likewise fixed in the edge of that sinus, in the spine of the ischium, and in the orbicular ligament of the joint of the hip. *Insertions.*

391. From thence its fibres, contracting in breadth, form a short tendon, by which the muscle is inserted in the anterior part of the upper edge of the great trochanter, above the great external convex rough surface in which the glutæus medius is fixed; and also in an oblique surface which runs down a little way between that last named and the rough anterior surface.

392. The tendon is increased in breadth in its oblique course downward, and is likewise inserted in the orbicular ligament chiefly by two particular tendinous productions or expansions.

§ 7. *Triceps Primus.*

393. This with the two following tricipital muscles, are fleshy and flat, and of different lengths, situated between the Os Pubis and the whole length of the Os Femoris, *Situation in general.* The first and second cross each other in such a manner, as that the muscle which is the first on the Os Pubis becomes the second on the Os Femoris, and the second on the Os Pubis is the first on the Os Femoris. The third muscle keeps its rank.

394. The triceps primus is fixed above by a short tendon to

Insertions. to the tuberosity or spine of the Os Pubis, and to the neighbouring part of the symphysis, its fibres mixing a little with those of the pectineus. From thence it runs down, increasing in breadth, and is inserted by fleshy fibres interiorly in the middle portion of the linea femoris aspera.

395. At the lower part of this insertion, a portion of the muscle separates from the rest, and sends off a long tendon, which, together with a like tendon from the triceps tertius, is inserted in the inner condyle of the extremity of the Os Femoris.

§ 8. *Triceps Secundus.*

396. This muscle is fixed above by fleshy fibres, below *Insertions.* the superior insertion of the triceps primus, in all the outside of the inferior ramus of the Os Pubis, as low as the foramen ovale, but seldom so low as the ramus of the Os Ischium. This insertion is broader than that of the former muscle.

397. From thence it runs down, and is inserted in the upper part of the linea aspera, between the pectineus and triceps primus, mixing a little with each of these muscles. This insertion appears sometimes divided.

§ 9. *Triceps Tertius.*

398. This muscle is fixed above by fleshy fibres to the anterior part of all the short ramus of the Ischium, and to a small part of the tuberosity of that bone. *Insertions.* This insertion covers some part of the tendon of the semi-membranosus, and is covered by that of the semi-nervosus.

399. From thence it runs down, and is inserted by fleshy fibres in the linea aspera almost from the little trochanter down to the middle of the Os Femoris. It goes lower down than the first triceps, sending off a separate portion like that of the muscle last mentioned.

400. These two portions join together, and form a common tendon, which running down to the lower extremity of the Os Femoris, is inserted in the back part of the tuberosity of

of the inner condyle. This separate portion is sometimes large enough to be taken for a distinct muscle, in which case we have a quadriceps instead of a triceps.

401. In all this progress this muscle is joined to the vastus internus by a perforated aponeurosis, through which the blood-vessels pass.

§ 10. *Pyriformis sive Pyramidalis.*

402. This is a small oblong muscle of the figure of a flat pear or pyramid, from whence it has its name. It is situated almost transversely between the Os Sacrum and Ilium, being covered and hid by the first two glutæi.

Situation in general.

403. It is fixed to the inferior lateral part of the Os Sacrum, by fleshy fibres, and to the neighbouring part of the anterior or concave side of that bone, by three digitations lying between the anterior holes. It is likewise fixed by a small insertion to the ligamentum sacro-sciaticum and edge of the great sinus of the Os Ilium.

Insertions.

404. From thence it runs transversely toward the joint of the hip, its fibres contracting in breadth, and ends in a small tendon which is inserted in the middle of the internal labium of the upper edge of the great trochanter, by two or three branches. The upper part of this tendon receives several fibres from the glutæus medius, and its lower part is united to the gemellus superior, and tendon of the obturator internus.

405. Sometimes there are two pyriformes separated by the nervus sciaticus.

§ 11. *Obturator Internus.*

406. This is a flat muscle almost triangular, situated in the bottom of the pelvis. It covers the foramen ovale, and almost all the inside of the Os Pubis and Ilium. It has its name from a Latin verb which signifies to fill up, cover, or stop.

Situation in general.

407. It is fixed to the internal labium of all the anterior half of the foramen ovale, a little to the neighbouring part of the obturator ligament; and also

Insertions.

both

both above and below the foramen. It is likewise fixed to the upper half of the inside of the Os Ischium from the upper oblique notch in the foramen ovale, to the superior part of the great posterior sinus of the Os Ilium, which would be more properly named *sinus iliacus*, than *sinus ischiadicus*.

408. From all this extent the fleshy fibres contracting in breadth run down below the spine of the Ischium, where they go out of the pelvis through the posterior notch of the Ischium. The inside of the body of this muscle, or that turned to the cavity of the pelvis, is pretty uniform; but the outside, or that turned toward the foramen ovale and which touches the bone, has four middle radiated tendons, which uniting at the posterior notch of the ischium, run over it from behind forward, as over a pulley, each tendon sliding in a particular cartilaginous channel described in the treatise of the skeleton.

409. Afterwards the four tendons having got out of the pelvis are very strictly united in one large flat tendon, which crossing over that of the pyriformis, unites with it, having first received on each side some additional fleshy fibres from the two gemelli.

410. The great tendon slides freely in a sort of membranous vagina formed by these muscles, as shall be observed hereafter, and is inserted in the middle of the superior part of the cavity of the great trochanter, adhering closely to the capsular ligament of the joint, and being united to the tendons of the glutæus minimus and pyriformis.

§ 12. *Gemelli.*

411. These are two small, flat, narrow muscles, situated almost transversely one above the other, between the tuberosity of the ischium and the great trochanter, immediately below the pyriformis, and parted by the tendon of the obturator internus.

412. The superior and smallest gemellus is fixed to the lower part of the spine of the ischium, to the superior part of the small ischiatic notch, and to a rough line which runs cross the outside of the ischium beginning from the spine, and continued under the acetabulum, where it is bent downward.

413. The

413. The inferior and largest gemellus is fixed to the superior and back part of the tuberosity of the ischium, and to a rough impression which runs cross the outside of the ischium from the lower extremity of the ischiatic notch, and is bent upward toward the other line, together with which it forms a sort of irregular semicircle.

414. Both these muscles have likewise a small insertion in the inside of the ischium, where being united together by a particular membrane, one of them joins the upper side, and the other the lower side of the obturator internus, a little after it has passed over the notch: they inclose it as in a bag, and continue to be fixed to it by fleshy fibres all the way to its extremity.

415. The superior muscle terminates wholly with the tendon of the obturator internus; but the inferior being broader, is inserted likewise by fleshy fibres in the orbicular ligament, and under the tendon of the same obturator.

§ 13. *Obturator Externus.*

416. This is a small flat muscle which fills up the foramen ovale of the Os Innominatum exteriorly, and reaches from thence to the great trochanter of the Os Femoris, behind the neck of that bone.

Situation in general.

417. It is fixed by fleshy fibres to the outer or anterior side of the Os Pubis, all the way to the foramen ovale, to the edge of that hole, next the small ramus of the ischium, and a little to the neighbouring parts of the obturator ligament.

Insertions.

418. From thence its fibres contracting in breadth, pass on the fore side of the great ramus of the ischium, under the acetabulum, where a tendon is formed, which continues its course behind the neck of the Os Femoris toward the great trochanter, and is inserted between the gemelli and quadratus, in a small fossula between the apex of the great trochanter, and the basis of the collum femoris.

§ 14. *Quadratus.*

419. This is a small, flat, fleshy muscle, of the figure of

Situation in general.

an oblong square, from whence it has its name. It is situated transversely between the tuberosity of the ischium and the great trochanter.

420. It is fixed by one extremity along that obtuse line which runs from under the acetabulum, toward the lower part of the tuberosity of the ischium. *Insertions.* From thence it runs directly toward the great trochanter, and is inserted in almost all the lower half of the oblong eminence in that apophysis; but chiefly in the small rising or tuberosity in the middle of that eminence.

§ 15. *Musculus Fasciæ Latæ.*

Situation in general.

421. This is a small and pretty long muscle, situated a little obliquely upward and downward on the forepart of the hip.

422. It is fixed above to the outside of the anterior superior spine of the Os Ilium, between the insertions of the *glutæus medius* and *sartorius*. From thence its fleshy fibres run down a little obliquely backward, forming a very flat body, four fingers breadth in length, and two in breadth. *Insertions.*

423. This body lies between two laminæ of the fascia lata, and is inserted therein by short tendinous fibres, which disappear at that place where the fascia adheres to the great trochanter and tendon of the *glutæus maximus*. We ought by no means therefore to look upon the fascia as a tendinous expansion of this muscle.

A R T. XI.

The muscles which move the bones of the leg on the Os Femoris.

424. **T**EN muscles are commonly reckoned to belong to this article. Most of them are very long, and situated lengthwise near each other, quite round the Os Femoris.

1. *Rectus Anterior sive Gracilis Anterior.*

2. *Vastus Externus.*

3. *Vastus Internus.*

4. *Cricurus*

- | | |
|---|-----------------------------|
| 4. <i>Crureus.</i> | 7. <i>Biceps.</i> |
| 5. <i>Sartorius.</i> | 8. <i>Semi-nervosus.</i> |
| 6. <i>Gracilis Internus five Rectus Internus.</i> | 9. <i>Semi membranofus.</i> |
| | 10. <i>Popliteus.</i> |

425. Of these ten muscles the popliteus only is small, and lies as it were out of the rank of the rest, being situated below the thigh. One portion of the biceps is likewise small.

426. These muscles not only move the leg upon the thigh, but also the thigh upon the leg, the popliteus excepted. Some of them likewise move the thigh upon the pelvis, and the pelvis upon the thigh, viz. the gracilis anterior, sartorius, gracilis, interior, the great portion of the biceps, semi-nervosus, and semi-membranofus.

427. These are not the only muscles which move the leg upon the thigh, and the thigh upon the leg. The gastrocnemii may likewise perform these motions, though commonly confined to the extension of the foot.

§ I. *Rectus Anterior five Gracilis Anterior.*

428. This muscle is as long as the Os Femoris, and lies directly along the forefide of the thigh, from whence it has the name of *rectus anterior*. The greatest part of it is fleshy, and the middle is broader than the two extremities. It is called *gracilis*, from its thinness or flatness. *Situation in general.*

429. It terminates above by a pretty strong tendon which is divided into two branches, one short and straight, the other long and bent. The short branch running up in a straight line is inserted in the anterior inferior spine of the Os Ilium. *Insertions.*

430. The long branch is inflected backward over the supercilium of the acetabulum, and runs in the direction thereof from the spine toward the great ischiatic sinus. It is strong and flat, adhering very closely to the bone, and covered by the orbicular ligament and the glutæus minimus; and therefore they who follow the common method in dissecting, often cut it off, and observe only the small branch of the tendon.

431. From thence the muscle runs down wholly fleshy and partly

partly penniform, some of its fibres meeting above and separating below. It is narrow at the upper extremity, and grows gradually broader toward the middle. Afterwards it contracts again in the same manner, and at the lower extremity of the Os Femoris ends in a flat broad tendon.

432. Through its whole course it lies between the two vasti, and covers the crureus; and its inferior tendon is inserted in the upper edge of the patella, from whence it sends down a small plane of tendinous fibres which adhere very closely to the convex side of that bone, and having reached the great ligament, seem to be lost therein.

§ 2. *Vastus Externus.*

Situation in general. 433. This is a very large fleshy muscle, almost as long as the Os Femoris, broad at the extremities and thick in the middle, lying on the outside of the thigh.

Insertions. 434. Its upper insertion being something tendinous, is in the posterior or convex rough surface of the great trochanter. It is likewise fixed by a fleshy insertion along the outside of the Os Femoris for above two thirds of its length downward, in the corresponding part of the linea aspera, and in the neighbouring portion of the fascia lata.

435. From all this extent the fleshy fibres running downward, and a little obliquely forward toward the rectus anterior, terminate insensibly in a kind of short aponeurosis, which is fixed in all the nearest edge of the tendon of the rectus, in the side of the patella, in the edge of the ligament of that bone, and in the neighbouring lateral part of the head of the tibia.

436. The body or belly of this muscle grows bigger gradually from its upper extremity to the middle, and from thence diminishes again by degrees. Its lowest fibres run in a little behind the rectus, and are inserted there.

§ 3. *Vastus Internus.*

Situation in general. 437. This muscle is very like the former, and situated in the same manner on the inside of the Os Femoris.

438. It

438. It is fixed above by a short flat tendon, in the anterior rough surface of the great trochanter, and by fleshy fibres in that oblique line which terminates the basis of the collum femoris anteriorly, on the fore-*Insertions.* side of the insertions of the psoas and iliacus; in the whole inside of the Os Femoris, and in the linea alpera on one side of the insertions of the three tricipites, almost down to the internal condyle.

439. From all this extent the fibres run downward, and a little obliquely forward, and the body of the muscle increases in the same manner as the vastus internus. It terminates below in the aponeurosis, which is fixed in the edge of the tendon of the rectus anterior, in the side of the patella, and of its tendinous ligament, and in the side of the head or upper extremity of the tibia.

§ 4. *Crureus.*

440. This is a fleshy mass, covering almost all the fore-*Situation in* side of the Os Femoris, between the two vasti, which likewise cover the edges of this muscle on each side. *general.*

441. It is fixed to the fore-*Insertions.* side of the Os Femoris, from the anterior surface of the great trochanter down to the lowest quarter of the bone, by fleshy fibres which run down successively over each other, between the two vasti, and are partly united to these two muscles, so as not to seem to form a distinct muscle.

442. It is not so thick as the two vasti; and as it is covered by them on each side, a sort of fleshy channel is formed by all the three, in which the rectus is lodged, covering the forepart of the crureus.

443. It terminates below in a tendinous aponeurosis, which joins the backside of the tendon of the rectus anterior, and the neighbouring edges of the extremities of the two vasti. Thus these four muscles form a common tendon, which is inserted in the places already mentioned.

§ 5. *Sartorius.*

Situation in general. 444. This is the longest muscle of the human body. It is flat, and about two fingers in breadth, situated obliquely along the inside of the thigh. It is called *sartorius*, for a reason which shall be given in describing its uses.

Insertions. 445. It is fixed above by a very short tendon, in the lower part of the anterior superior spine of the Os Ilium, before the musculus fasciæ latæ. The beginning of its body lies in the notch between the two anterior spines of that bone.

446. From thence it runs down obliquely over the vastus internus and other muscles that lie near it, all the way to the inside of the knee, where it terminates in a small tendon which grows broader near its extremity, and is inserted obliquely and a little transversely, in the forepart of the inside of the head of the tibia, near the spine or tuberosity of that bone, immediately above the insertion of the gracilis interior.

447. The fleshy body of this muscle is inclosed in a vagina formed by an expansion of the fascia lata. Its fibres in general are longitudinal, and where its lower tendon turns obliquely round toward the head of the tibia, it seems to be braced down and secured in its place, by a tendinous frænum or vagina. A little before it is inserted, it detaches a distinct aponeurosis or tendinous branch, which runs obliquely downward on the inside of the tibia.

§ 6. *Gracilis Interior sive Rectus Interior.*

Situation in general. 448. This is a long thin muscle lying in a straight line on the inside of the thigh, between the Os Pubis and the knee; and from this situation and structure its names are taken.

Insertions. 449. It is fixed in the edge of the inferior branch of the Os Pubis near the symphysis, by a broad and very short tendon, on one side of the insertion of the triceps secundus, but a little lower down.

450. From thence the fleshy fibres contracting a little in breadth, run down to the internal condyle of the Os Femoris,

ris, where they terminate in a thin tendon, which afterwards degenerates into a kind of aponeurosis, and is inserted in the forepart of the inside of the head of the tibia.

451. This tendon is inserted immediately below the sartorius, by which it is partly covered, and above the semi-tendinosus, which it partly covers, mixing some fibres with it. Before it ends, it makes the same oblique turn, and is braced down in the same manner as the tendon of the sartorius, and it sends the same kind of aponeurosis obliquely downward on the inside of the tibia.

§ 7. *Biceps.*

452. This muscle is made up of two portions, one long the other short, and they end in a common tendon. Both portions are fleshy and considerably thick, being situated on the back and outside of the thigh between the buttock and ham.

Situation in general.

453. The great portion is fixed above by a strong tendon in the posterior and lower part of the tuberosity of the ischium under the insertion of the inferior gemellus, and close behind that of the semi-nervosus. From thence it runs down toward the lower extremity of the thigh, where it meets the other portion, and joins with it in forming a common tendon.

454. The small portion is fixed by fleshy fibres to the outside of the linea aspera below its middle, and to the fascia lata where it forms a septum between the triceps and vastus externus. From thence the fibres run down a little way, and then meeting the great portion, a common tendon is formed between them.

455. This strong tendon runs down to the outer and back part of the knee, and is inserted in the lateral ligament of the joint and in the head of the fibula by two very short tendinous branches. It sometimes sends off a tendinous expansion, which is often unskillfully cut off with the fat.

§ 8. *Semi-Nervosus.*

456. This is a long muscle half fleshy and half tendinous, or like a nerve, from whence

Situation in general.

it

it has its name. It is situated a little obliquely on the posterior and inner part of the thigh.

457. It is fixed above to the posterior part of the tuberosity of the ischium, immediately before and a little more inward than the biceps. It is afterwards fixed by fleshy fibres to the tendon of the biceps for about the breadth of three fingers, much in the same manner as the coraco-brachialis is fixed to the biceps of the arm.

458. From thence it runs down fleshy toward the lower part of the inside of the thigh, having a sort of tendinous intersection in the inner part of its fleshy portion. Having reached below the middle of the thigh, it terminates in a small, long, round tendon, which runs down to the inside of the knee behind that of the gracilis, where it expands in breadth.

459. It is inserted in the inside of the upper part of the tibia about two or three fingers breadth below the tuberosity or spine, immediately under the tendon of the gracilis internus with which it communicates. It has the same oblique turn with the gracilis and sartorius, and sends off a like kind of aponeurosis.

§ 9. *Semi-Membranosus.*

460. This is a long thin muscle, partly tendinous, from whence it has its name, and situated on the backside of the thigh a little towards the inside.

461. It is fixed above by a broad tendon or long aponeurosis in the irregular obtuse, prominent line which goes from the acetabulum to the tuberosity of the ischium, a little above the insertion of the semi-nervosus, and between those of the gemellus inferior and quadratus, mixing some fibres with the triceps tertius.

462. From thence it runs down fleshy in an oblique direction behind the inner condyle of the Os Femoris, below which it terminates in a thick tendon, which is inserted in the posterior and interior side of the inner condyle of the tibia, by three short branches, the first or uppermost of which goes a little toward the inside, the second, more backward, and

and the third, lower down. Before it is inserted, it sends off sometimes an aponeurosis like that of the biceps.

§ 10. *Popliteus.*

463. This is a small muscle, obliquely pyramidal, situated under the ham, from whence it has its name. *Situation in general.*

464. It is fixed above by a strong narrow tendon to the outer edge of the inner condyle of the Os Femoris, and to the neighbouring posterior ligament of the joint. From thence it runs obliquely downward under the inner condyle of the Os Femoris; its flat and pretty thick fleshy body increasing gradually in breadth, till it is fixed in the backside of the head of the tibia all the way to the oblique line or impression observable on that side. *Insertions.*

A R T. XII.

The muscles which move the tarsus on the leg.

465. **T**HE motions of the tarsus are supposed to be performed by nine muscles situated in the leg; three on the fore-side, and six on the back-side, viz.

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| 1. <i>Tibialis Anticus.</i> | 6. <i>Soleus.</i> |
| 2. <i>Peronæus Medius.</i> | 7. <i>Tibialis Gracilis vulgo Plantaris.</i> |
| 3. <i>Peronæus Minimus.</i> | 8. <i>Tibialis Posticus.</i> |
| 4. 5. <i>Gastrocnemii.</i> | 9. <i>Peronæus Maximus.</i> |

466. These muscles, three of which are anterior and six posterior, not only move the tarsus on the leg, but also the leg on the tarsus, except the tibialis gracilis or plantaris. These motions may likewise be performed by four muscles which belong to the toes, the names of which are these:

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|---------------------------------------|-------------------------------------|
| 10. <i>Extensor Pollicis Longus.</i> | 12. <i>Flexor Pollicis Longus.</i> |
| 11. <i>Extensor Digitorum Longus.</i> | 13. <i>Flexor Digitorum Longus.</i> |

§ 1. *Tibialis Anticus.*

467. This is a long muscle, fleshy at the upper part, and tendinous

*Situation in
general*

tendinous at the lower, situated on the fore-side of the leg between the tibia and the extensor digitorum longus.

468. It is fixed above by fleshy fibres in the upper third part of the external labium of the crista tibiæ, and of the inside of the aponeurosis tibialis, or of that ligamentary expansion which goes between the crista tibiæ and the anterior angle of the fibula. It is likewise fixed obliquely in the upper two thirds of the outside of the tibia, or that next the fibula.

469. From thence it runs down, and ends in a tendon, which first passes through a ring of the common annular ligament, and then through another separate ring situated lower down. Afterwards the tendon is fixed partly in the upper and inner part of the Os Cuboides, and partly in the inside of the first bone of the metatarsus.

§ 2. *Peronæus Medius vulgo Peronæus Anticus.*

*Situation in
general.*

470. This is a long muscle, situated anteriorly on the middle part of the fibula.

471. It is fixed above by fleshy fibres, to more than the middle third part of the anterior or outside of the fibula, and to the neighbouring part of the aponeurosis tibialis.

472. It is likewise fixed to a production from the inside of that aponeurosis which runs to the upper part of the tibia, and there serves for a middle septum between this muscle and the extensor digitorum longus.

473. From thence it runs down and forms a tendon, which going in the direction of the oblique line on the fibula, passes behind the external malleolus, and then through an annular ligament common to it and to the peronæus maximus, and is afterwards inserted in the tuberosity at the basis of the fifth metatarsal bone, sending off a small tendon to the first phalanx of the little toe.

§ 3. *Peronæus Minimus.*

*Situation in
general.*

474. This is a small muscle, commonly thought to be a portion of the extensor digitorum longus, though it is easily separable from it.

475. It

475. It is fixed by fleshy fibres in the lower half of the inside of the fibula, between two oblique bony lines, on one side of the lower part of the extensor digitorum longus, to which muscle it is simply contiguous. *Insertions.*

476. From thence it runs down, contracting in breadth, and passes with the extensor longus through the common annular ligament forming a flat tendon, which soon separates from those of the extensor, and is inserted near the basis of the fifth metatarsal bone.

477. It is distinguished from the other two peronæi by a septum or production of the ligamentary aponeurosis of the tibia.

§ 4. *Gastrocnemii.*

478. These are two thick, pretty broad and oblong muscles, situated laterally with respect to each other in the same plane, under the poples, and forming a great part of what is called *the calf of the leg*. That which lies next the tibia is called *internus*, and that next the fibula, *externus*; and because they form, as it were, the belly of the leg, they have been termed in Greek, *gastrocnemii*. *Situation in general.*

479. Each muscle is fixed above by a flat tendon, to the posterior part of the lower extremity of the Os Femoris, behind the lateral tuberosity of each condyle, adhering closely to the posterior ligaments of the joint of the knee. *Insertions.*

480. From thence they run down, each forming a large and pretty broad fleshy body, irregularly oval. The externus covers the popliteus, being larger and broader, spreading more laterally, and running lower down than the internus, the fleshy body of which begins higher up than the other.

481. About the middle of the leg they end in a strong, broad, common tendon, which contracts a little in breadth as it descends, and is inserted in the posterior extremity of the Os Calcis, together with the tendon of the soleus.

482. The superior tendons of these muscles, become gradually cartilaginous in aged persons, and at last ossify near the condyles; the bony portions looking like sesamoide bones.

It is sometimes very late before they are hardened in this manner, and sometimes one grows hard before the other.

§ 5. *Soleus.*

483. This is a large, fleshy, flat muscle, nearly of an oval figure, and thicker in the middle than at the edges. It has its name from its supposed likeness to a sole. It is situated on the backside of the leg, lower down than the *gastrocnemii* by which it is covered, and these three muscles form the calf of the leg.

Situation in general. 484. It is fixed above, partly to the tibia and partly to the fibula. It is fixed to above one third of the upper, part of the backside of the fibula, and a little to the articular ligament of the head of this bone. It is likewise fixed to the backside of the tibia from the oblique line or impression which terminates the insertion of the *popliteus*, down to the middle of the internal angle of the bone.

485. Afterwards leaving these two bones it ends in a broad strong tendon, which, together with that of the *gastrocnemii*, forms what is called *tendo Achillis*. This strong tendon contracts a little in its passage to the *Os Calcis*, and then expanding a little, it is inserted obliquely in the backside of that bone all the way to the tuberosity. The outer or posterior fibres of this large tendon are the longest, the inner or anterior fibres shortest, and the rest are longer or shorter in proportion to their nearness to these two portions.

486. The fleshy body of the *soleus* seems to consist of two planes of fibres at least, that on the backside of the muscle being the most simple; and the other, or that next the bone, being penniform.

487. This muscle and the two *gastrocnemii* form what anatomists call a *true triceps*.

§ 6. *Tibialis Gracilis vulgo Plantaris.*

Situation in general. 488. This is a small pyriform muscle, situated obliquely in the ham below the external condyle of the *Os Femoris*, between the *popliteus* and *gastrocnemius externus*; and its tendon, which is long, flat,

flat, and very small, runs down on the side of the gastrocnemius internus all the way to the heel.

489. The fleshy body, which is only about two inches in length and one in breadth, is fixed by a short flat tendon above the outer edge of the exterior condyle of the Os Femoris, on one side of the gastrocnemius externus. From thence the fleshy body runs obliquely over the edge of the popliteus, and terminates in a very small, long, flat tendon. *Insertions.*

490. This tendon runs between the body of the gastrocnemius externus and soleus, all the way to the inner edge of the upper part of the tendo Achillis; and from thence continuing its course downward, it joins this tendon, and is inserted, together with it, in the outside of the posterior part of the Os Calcis, without communicating with the aponeurosis plantaris.

491. Sometimes this muscle is wanting, and sometimes it is situated lower down.

§ 7. *Tibialis Posticus.*

492. This is a long fleshy penniform muscle, broader above than below, situated between the tibia and fibula, on the backside of the leg, and covered by the extensor digitorum longus. *Situation in general.*

493. It is fixed above by fleshy fibres, immediately under the articulation of the tibia and fibula, to the nearest parts of these two bones, chiefly to the tibia, reaching to the lateral parts of that bone, above the interosseous ligament which is here wanting. *Insertions.*

494. From thence its insertion is extended below the oblique line or impression in the tibia, over all the neighbouring part of the interosseous ligament, and through more than the upper half of the internal angle of the fibula.

495. Through all this space it is fleshy, penniform, and covered by the extensor digitorum longus, which sometimes communicates with it by a middle tendon, and sends off an aponeurosis to it, which does the office of a frænum.

496. After this, it forms a tendon which runs down behind the inner malleolus, through a cartilaginous groove and an annular ligament, and passing under the malleolus, is inserted in the tuberosity or lower part of the Os Scaphoides.

This

This tendon is sometimes divided into two, one of which crossing a little over that of the peronæus longus is fixed in the Os Cuboides.

§ 8. *Peronæus Maximus vulgo Peronæus Posterior.*

Situation in general. 497. This is a long penniform muscle lying on the fibula.

498. It is fixed above to the anterior and outer part of the head of the fibula, and to a small portion of the head of the tibia; then to the outside of the neck of the fibula, to the upper half of the external angle of that bone, and to the aponeurosis tibialis, which at that place makes a septum between this muscle and the extensor pollicis.

499. From thence turning a little backward according to the direction of the bone, it forms a considerable tendon, which running down behind the external malleolus, passes through a kind of hollow groove, and through an annular ligament common to it, and to the tendon of the peronæus medius which lies before it. It passes likewise through an annular ligament on the outer and anterior part of the Os Calcis, and under the small lateral tuberosity sometimes found there.

500. Afterwards running through the oblique groove in the lower side of the Os Cuboides, it is inserted in the side of the basis of the first metatarsal bone, and also a little in the basis of the Os Cuneiforme majus.

501. The fleshy body of this muscle cannot always be distinguished from that of the peronæus medius.

A R T. XIII.

The Muscles which move the metatarsus and toes.

§ 1. *Extensor Pollicis Longus.*

Situation in general. 502. **T**HIS is a thin single muscle lying between the tibialis anticus and extensor digitorum longus, by which it is almost hid.

503. It is fixed to the inside of the fibula near the interosseous ligament, from the neck down to the lowest quarter of that bone; to the interosseous ligament through

through the same space, and a little to the lower extremity of the tibia next the fibula.

504. There it ends in a considerable tendon, which passing through a distinct ring of the common annular ligament, and then through a membranous vagina, is inserted in the basis of the first phalanx of the great toe, and continued from thence up to the second.

§ 2. *Flexor Pollicis Longus.*

505. This is a pretty long muscle situated in the posterior and lower part of the leg. *Situation in general.*

506. It is fixed in the lower half of the backside of the fibula, its insertion reaching almost as far as the external malleolus. The fleshy body advances on the inside of that bone towards the tibia, according to the oblique direction of that side, and ends in a large tendon. *Insertions.*

507. This tendon passes behind the lower extremity of the tibia, toward the inner angle, then through a small notch in the inner and backside of the astragalus, and through an annular ligament or ligamentary vagina continued under the lateral arch of the Os Calcis.

508. From thence it advances to the great toe, and passing through the interstice between the two sesamoide bones, in the ligamentary vagina of the first phalanx, is inserted in the lower part of the second. In some subjects, this vagina is almost cartilaginous.

509. The two sesamoide bones are strongly connected together by ligaments, and also to the lower edge of the first phalanx, in such a manner as to slide easily on the two inferior depressions or double pulley of the head of the first metatarsal bone. The ligament by which they are fixed to the first phalanx is very thick, and has the appearance of a cartilage as much as the vagina.

§ 3. *Thenar.*

510. This muscle is made up of several portions, and lies on the inner edge of the sole of the foot. *Situation in general.*

511. It

511. It is fixed by three or four fleshy fasciculi to the lower and inner part of the Os Calcis, Os Scaphoides, and Os Cuneiforme majus. It is likewise fixed a little in the annular ligament under the inner angle, which belongs to the tendon of the flexor longus.

512. From all these different insertions the fleshy fasciculi approach each other as they advance forward under the first bone of the metatarsus, and are fixed partly in the internal sesamoide bone, and partly in the inside of the first phalanx near its basis.

513. There is another fasciculus fixed by one end to the Os Scaphoides and Os Cuneiforme majus, and by the other to the external sesamoide bone, and outside of the first phalanx of the great toe.

§ 4. *Antithenar.*

Situation in general. 514. This is a small compound muscle, lying obliquely under the metatarsal bones.

515. It is fixed posteriorly in the lower parts of the second, third and fourth metatarsal bones near their bases; in the ligament belonging to the first and second of these bones; in the neighbouring ligaments belonging to the bones of the tarsus; and lastly, in a lateral aponeurosis of the muscle commonly called *hypothenar*.

516. All these portions contracting into a small compass, are inserted in the outside of the external sesamoide bone, and of the first phalanx of the great toe.

§ 5. *Extensor Digitorum Longus.*

Situation in general. 517. This is a long muscle, fleshy in the upper part, and tendinous in the lower, lying between the tibialis anticus and peronæus maximus.

518. It is fixed above by fleshy fibres in the outside of the head of the tibia, and inside of the head of the fibula; in the upper part of the interosseus ligament, through three fourths of the length of the fibula; and through the same space, in the tendinous septum belonging to the anterior angle of that bone.

519. It seems to mix some fibres on each side with the two first

first peronæi and tibialis anticus; and it is very closely united with the peronæus minimus, which has for that reason been looked upon as a portion of this extensor.

520. It contracts in breadth a little above the annular ligament, and in passing through it, is divided into three tendons, the first of which is afterwards divided into two. These four tendons are inserted along the upper or convex side of the four small toes.

§ 6. *Extensor Digitorum Brevis.*

521. This is a small complex muscle lying obliquely on the convex side of the foot, being likewise termed *pedieus*. *Situation in general.*

522. It is fixed in the upper and outer side of the anterior apophysis of the astragalus, and in the neighbouring part of the upper side of that bone. From thence it runs obliquely from without inwards, under the tendons of the peronæus minimus and extensor digitorum longus, being divided into four fleshy portions which terminate in the same number of tendons. *Insertions.*

523. The first tendon is inserted in the upper or convex part of the first phalanx of the great toe. The other three joining with those of the extensor longus are inserted along the convex sides of all the phalanges of the three following toes; and when there is a fifth tendon, which happens very seldom, it goes in the same manner to the little toe.

524. As this muscle is situated obliquely, its tendons and those of the extensor longus cross each other a little; and after their common insertion in the first phalanges of the toes, those of the short extensor run along the two other phalanges, almost on the outside of the others. All these tendons communicate by aponeuroses in the same manner as those of the hand.

§ 7. *Flexor Digitorum Brevis sive Perforatus Pedis.*

525. This is the undermost of all the common muscles of the toes, being situated immediately above the aponeurosis plantaris, which it resembles something in figure; and hence we see that it has been very improperly termed *sublimis*. *Situation general.*

526. It is fixed by fleshy fibres to the anterior and lower part of the great tuberosity of the Os Calcis; and to the neighbouring part of the upper side of the aponeurosis plantaris.

527. From thence it runs forward, being divided into four fleshy portions, which terminate in the same number of tendons, split at their extremities in the same manner as those of the sublimis or perforatus of the hand, and inserted in the second phalanges of the four small toes, a little nearer the inside than in the hand.

§ 8. *Flexor Digitorum Longus sive Perforans Pedis.*

Situation in general. 528. This is a long muscle, fleshy above and tendinous below, lying on the backside of the leg between the tibia and the flexor pollicis longus, covered by the soleus, and covering the tibialis posterior.

Insertions. 529. It is fixed above by fleshy fibres to a little more than the middle third part of the backside of the tibia near its external angle, below the insertion of the soleus; and also to a kind of ligament which runs down from the middle of the tibia. It afterwards ends in a tendon which passes behind the inner angle, on one side, and a little behind the tibialis posterior, in a separate annular ligament.

530. From thence it runs under the sole of the foot, sending off a detachment, by which it communicates with the flexor pollicis longus. There it is divided into four small flat tendons, which go to the third phalanges of the four small toes in the same manner as the perforans of the hand.

531. These four tendons agree likewise in this with those of the hand, that they give insertions to the lumbricales; but they differ from them in this, that before their separation they are joined laterally by an auxiliary fleshy body, which I name *flexor digitorum accessorius*.

§ 9. *Flexor Digitorum Accessorius.*

Situation in general. 532. This is a flat and pretty long fleshy mass, situated obliquely under the sole of the foot, which from its situation and figure was formerly termed *caro plantæ pedis quadrata*.

533. This

533. This muscle is fixed posteriorly by one fleshy portion, in the lower side of the Os Calcis, and in the anterior tuberosity on that side, and by the other in the neighbouring ligament which joins this bone to the astragalus. *Inserctions.*

534. From thence the two portions run obliquely to the middle of the sole of the foot, and there unite in a flat long and irregularly square muscular mass, which is fixed to the outer edge of the fasciculus of the tendons of the flexor longus, to which it serves as a frænum at that place.

535. This muscle might more properly be named *plantaris*, than that which is commonly so called, to which I have given the name of *tibialis gracilis*.

§ 10. *Lumbricales.*

536. These are four small muscles, situated more or less longitudinally under the sole of the foot. *Situation in general.*

537. They are fixed by their fleshy extremities to the four tendons of the flexor digitorum longus near the insertion of the flexor accessorius. The first muscle is fixed to the inside of the first tendon; the second, to the tendinous fork formed by the two first tendons; the third, to the tendinous fork made by the second and third tendons; and the fourth, in the same manner to the third and fourth tendons, but commonly most to the third. *Inserctions.*

538. From thence these four muscles run to the toes, and there terminate in the same number of small tendons which are inserted in the first phalanges of the toes much after the same manner as in the hand. They are termed *lumbricales* or *vermiculares*, because of the resemblance they bear to worms.

§ 11. *Transversalis Digitorum.*

539. This is a small muscle which lies transversely under the basis of the first phalanges, and which at first sight appears to be a simple muscular body fixed by one end to the great toe, and by the other to the little toe. *Situation in general.*

540. When this muscle is carefully examined, we find that

Insertions. it is fixed by a very short common tendon to the outside of the basis of the first phalanx of the great toe, conjointly with the antithenar; and by three different portions or digitations, to the three interosseous ligaments which connect the heads of the four metatarsal bones next the great toe, laterally to each other. These three portions are very slender, and gradually cover each other.

541. This muscle might be reckoned a second antithenar.

§ 12. *Interossei.*

Situation in general. 542. These are seven small muscles which fill up the four interstices between the metatarsal bones, much after the same manner as in the hand, The four largest are superior, the other three inferior. The common division of them into external and internal is very improper.

Insertions. 543. The first of the superior muscles is fixed posteriorly by fleshy fibres, in the ligament which connects the basis of the two first metatarsal bones; in the outside of the first bone, and in the upper part of the inside of the second. It ends in a small tendon, which is inserted in the inside of the first phalanx of the second toe.

544. The other three are fixed by fleshy fibres in the inner and upper parts of the last three metatarsal bones, and in the outer and upper parts of the second, third, and fourth bones. They likewise end in tendons which are inserted in the outsides of the first phalanges of the second, third, and fourth toes.

545. The three inferior muscles are fixed proportionably by fleshy fibres to the lower parts of these bones, chiefly to the third, fourth, and fifth, and to the ligaments belonging to their basis. The first inferior interosseous is likewise fixed by some fibres to the tendon of the peronæus maximus. The tendons of these three muscles are inserted in the insides of the bases of the first phalanges of the last three toes.

§ 13. *Metatarsius.*

546. This is a fleshy mass lying under the sole of the foot. It is fixed by one end, in the forepart of the great tuberosity

ty of the Os Calcis; and running forward from thence, it terminates in a kind of short tendon which is fixed in the tuberosity and posterior part of the lower side of the fifth bone of the metatarsus. It may move this bone much after the same manner as the metacarpus moves the fourth bone of the metacarpus.

§ 14, *Parathenar Major.*

547. This is a pretty long muscle, forming part of the outer edge of the sole of the foot. It is commonly termed *bypothenar*, but very improperly, according to the signification of that word. *Situation.*

548. It is fixed backwards, by a fleshy body, to the outer part of the lower side of the Os Calcis, from the small posterior external tuberosity all the way to the anterior tuberosity. There it joins the metatarsus, and at the basis of the fifth metatarsal bone, separates from it again, and forms a tendon which is inserted in the outside of the first phalanx of the little toe near its basis, and near the insertion of the parathenar minor. *Insertions.*

§ 15. *Parathenar Minor.*

549. This is a fleshy muscle fixed along the posterior half of the outer and lower side of the fifth bone of the metatarsus. It terminates under the head of that bone, in a tendon which is inserted in the lower part of the basis of the first phalanx of the little toe.

550. The tendinous insertion of this muscle is very closely united to the cartilaginous ligament mentioned in the description of the fresh bones. The same thing is to be observed concerning the other muscles which go to the lower parts of the basis of the first and second phalanges of the toes. In aged persons some parts of these ligaments are often turned to bone, and thereby form these bony portions which are taken distinct for sesamoide bones, as has been already said.

A R T. XIII.

The muscles employed in respiration.

551. **I** Reduce these muscles to a smaller number than is commonly done, viz.

- | | |
|---------------------------------------|---|
| 1. <i>Diaphragma.</i> | 6. <i>Supra-costales.</i> |
| 2. <i>Scaleni.</i> | 7. <i>Infra-costales.</i> |
| 3. <i>Serrati Postici Superiores.</i> | 8. <i>Sterno-costales vulgo Triangulares.</i> |
| 4. <i>Serrati Postici inferiores.</i> | |
| 5. <i>Inter-costales.</i> | |

552. The diaphragm is one muscle in a middle situation in the body. All the rest are regularly disposed in pairs on the two sides of the thorax, and several of them are in great numbers. The subclavii and sacro-lumbares are commonly joined to these muscles, and some anatomists add the pectorales minores, and serrati majores. I have already ranked the subclavii pectorales minores, and serrati majores, among the muscles that move the shoulders; and I place the sacro-lumbares among those that perform the particular motions of the back.

§ 1. *Diaphragma.*

553. This is a very broad and thin muscle, situated at the basis of the thorax, and serving as a transverse partition to separate that cavity from the abdomen. For this reason the Greeks termed it *diaphragma*, and the Latins, *septum transversum*. It forms an oblique inclined arch, the forepart of which is highest, and the posterior part lowest, making a very acute angle with the back.

554. It is looked upon as a double and digastric muscle, made up of two different portions, one large and *Division.* superior, called *the great muscle of the diaphragm*; the other small and inferior, appearing like an appendix to the other, called *the small or inferior muscle of the diaphragm*.

555. The great or principal muscle is fleshy in its circumference,

ference, and tendinous and aponeurotic in the middle, which, for that reason, is commonly called *centrum nervum sive tendinosum*. It must not however be imagined that this middle part is of small extent, or that it is round, because anatomists have named it *the centre*; for, in so doing, they had regard only to its situation, not to its form, or to the space it takes up. It is of a considerable breadth, and represents in some measure a trefoil leaf, supposing the part to which the footstalk is fixed to be sloped, and that this slope is turned backward, and the middle convex part forward; and therefore, in the public courses which I gave at the royal garden for the space of twelve years, I chose to call it simply *the middle aponeurosis* or *aponeurotic plane of the diaphragm*.

556. The fleshy circumference is radiated, the fibres of which it is made up, being fixed by one extremity to the edge of the middle aponeurosis, and by the other to all the basis of the cavity of the thorax, being inserted by digitations in the lower parts of the appendix of the sternum, of the lowest true ribs, of all the false ribs, and in the neighbouring vertebræ. *Insertions.*

557. We have therefore three kinds of insertions, one sternal, twelve costal, six on each side, and two vertebral, one on each side. These last are very small, and sometimes scarcely perceivable. The costal insertions join those of the transversalis abdominis, but do not mix with them, as they seem to do, before the membrane which covers them is removed. I need not mention here some communicating fibres of the same nature with those found in other muscles, as for instance, between the obliquus externus and pectoralis major.

558. The fibres inserted in the appendix ensiformis, run from behind directly forward, and form a small parallel plane. I have sometimes observed a fasciculus of fibres detached from the under side of this plane, to run down on the inside of the linea alba, in which it is inserted near the umbilicus.

559. The first costal insertion runs a little obliquely towards the cartilage of the seventh true rib, a triangular space being left between this and the sternal insertion, at which the pleura and peritonæum meet, as shall be said hereafter. The insertion of these fibres is very broad, taking up about two thirds of the cartilage of the seventh rib, and a small part of the bone,

bone, from whence it reaches beyond the angle of the cartilage.

560. The second insertion is into the whole cartilage of the first false rib; the third partly in the bone, and partly in the cartilage of the second false rib; the fourth in the bone, and sometimes a little in the cartilage of the third false rib; the fifth in the bone and a little in the cartilage of the fourth false rib, being broader than the rest.

561. The sixth is in the cartilage of the last false rib, and almost through the whole length of the bone. At the head of this rib, it joins the vertebral insertion which runs from the lateral part of the last vertebra of the back, to the first vertebra of the loins.

562. Between this vertebral insertion and the second muscle of the diaphragm, a small triangular interstice is sometimes left like that which I mentioned in speaking of the first insertion. This insertion and that in the last false rib, join the upper extremities of the psoas and triangularis or quadratus lumborum, and sends off to them some communicating fibres. The common plane of these last insertions, by the separation of their fibres, form a hole, through which a bundle of nerves passes.

563. It is to be observed, that the lateral insertions of the great muscle of the diaphragm on the right side appear to be lower than those on the left side; and that the right lateral portion appears to be larger than the left, as being more arched.

564. The small muscle of the diaphragm is thicker than the other, but of much less extent. It is situated along the fore-side of the bodies of the last vertebra of the back and several of those of the loins, being turned a little to the left hand. It is of an oblong form, representing in some measure a fleshy collar, the two lateral portions of which cross each other, and afterwards become tendinous toward the lower part.

565. The upper part of the body of this muscle is fixed in the slope of the middle aponeurosis of the great muscle. The outer edges of the alæ or lateral portions join the posterior plane of the great muscle, and these portions adhere to the body of the last vertebra of the back. The extremities, called

led likewise *pillars* or *crura*, are inserted by several tendinous digitations in the vertebræ of the loins.

566. The upper part of the fleshy body is formed by a particular intertexture of fibres belonging to the two *alæ*. These two *alæ*, whereof that toward the right hand is generally the most considerable, part from each other, and form an oval hole, terminated in the lower part by fibres detached from the inside of each *ala*, immediately above the last vertebra of the back. These fibres decussate and cross each other, and afterwards those that come from each *ala*, join that on the other side, so that each of the *crura* is a production of both *alæ*.

567. The fibres that come from the left *ala*, cross over those from the right *ala*, and this again sends a small fasciculus of fibres over those of the left *ala*; afterwards the two *crura* part from each other.

568. The right crus is larger and longer than the left, and is always inserted in the four upper vertebræ of the loins, and often in the fifth likewise, by the same number of digitations, which become more and more tendinous as they descend, and at length are expanded in form of an aponeurosis. This crus lies more on the middle of the bodies of the vertebræ than on the right side.

569. The left crus is smaller and shorter, and lies more on the sides of the vertebræ. It is fixed by digitations to the three upper vertebræ of the loins, seldom reaching lower. The lower part of it is expanded in the same manner as the other; and the two expansions sometimes meet together.

570. The oval opening of this inferior muscle of the diaphragm, gives passage to the extremity of the œsophagus, and the aorta lies in the interstice between the two *crura*. Immediately above the opening or hole, a thin fasciculus of fibres is sent off to the stomach; and I have sometimes observed a larger fasciculus at the lower extremity of the hole, sent off chiefly from the right *ala*, and accompanied by some tendinous fibres from the left; which seemed to run to the mesentery.

571. In the middle aponeurosis of the great muscle, a little to the right of the anterior part of the slope, near the small muscle, is a round opening which transmits the trunk of the lower vena cava. The border or circumference of this opening

is very artfully formed by an oblique and successive intertexture of tendinous fibres, almost like the edge of a wicker-basket; and is consequently incapable either of dilatation or contraction, by the action of the diaphragm.

572. We find therefore three considerable openings in the diaphragm; one round and tendinous for the passage of the vena cava; one oval and fleshy for the extremity of the œsophagus; and one forked, partly fleshy and partly tendinous, for the aorta. The round opening is to the right hand, close to the upper part of the right ala of the small muscle; the oval opening is a little to the left, so that the right ala which is between these two holes, lies almost directly over-against the middle of the body of the eleventh vertebra of the back; the tendinous fork is under the oval opening, but a little more toward the middle.

573. This situation well considered, will serve to justify, in some measure, the descriptions and figures of the ancient anatomists, especially since the right ala of the small muscle is larger than the left, and since it was an easy matter, in taking out the diaphragm, and spreading it on a board, to extend it too much toward both sides.

§ 2. *Scaleni.*

Situation in general and division.

574. These are compound muscles, irregularly triangular, and from this figure, the ancient Greeks gave them their name. They reckoned them to be only two in number, situated laterally on the vertebræ of the neck, all the way down to the first and second true ribs. Afterwards they were divided into six, three lying on each side; but I have commonly found no more than two on each side, one lying upon the other; the first of which I name *scalenus primus* or *primæ costæ*, the other *scalenus secundus* or *secundæ costæ*.

575. The *scalenus primus* is fixed to the upper part of the outside of the first rib, by two distinct portions, called commonly *branches*, one anterior, the other posterior. The anterior branch is fixed to the middle portion of the rib, about an inch from the cartilage. From thence it runs obliquely upward, and is inserted in the transverse apophysis of the sixth, fifth, and sometimes of the third vertebra of the neck.

576. The

576. The posterior branch is fixed more backward in the first rib, an interstice of about an inch being left between it and the other branch, through which the axillary artery and brachial nerves are transmitted. From thence it runs up obliquely behind the former, and is inserted in all the transverse apophyses of the neck.

577. The scalenus secundus is fixed a little more backward in the external labium of the upper edge of the second rib, sometimes by two separate portions, and sometimes without any division. The anterior portion is fixed immediately under the posterior portion of the first scalenus, by a short flat tendon, united a little with the first intercostal muscle. From thence it runs up over the posterior portion of the first scalenus, communicating likewise with that muscle, and is fixed by insertions, partly tendinous and partly fleshy, in the transverse apophyses of the four first vertebræ of the neck.

578. The posterior portion is fixed in the second rib more backward than the other. From thence it runs up, being divided into two portions, whereof one is inserted in the transverse apophyses of the three first vertebræ of the neck, behind the scalenus primus. The other portion runs up behind the former, and is inserted in the transverse apophyses of the two first vertebræ.

579. The vertebral insertions of both scaleni vary, they being sometimes confounded with each other, and sometimes with those of the neighbouring muscles. Behind the scalenus secundus, there is a small fleshy plane inserted in the transverse apophysis of the last vertebra of the neck, and in the second rib. This does not belong to the scaleni, but is the first of the muscoli supra-costales, or levatores costarum, as they are commonly called.

580. In dissecting the anterior portion of the second scalenus, I have observed a small muscle fixed to the extremity of the transverse apophysis of the last vertebra of the neck, which, having run down from thence to the inner and lower part of the first true rib, was slightly inserted there, and seemed to continue its course to the convex side of the pleura. I have likewise seen all the scaleni inserted in the first rib.

§ 3. *Serratus Posticus Superior.*

581. This is a flat thin muscle, situated on the upper part of the back. It is fixed on one side by a broad aponeurosis, to the lower part of the posterior cervical ligament, and to the spinal apophyses of the two last vertebræ of the neck and two first of the back.

Situation in general and insertions.

582. From thence it runs down a little obliquely forward and is inserted, by broad fleshy digitations, in the posterior part of the second, third, fourth, and sometimes of the fifth true ribs, near their angles; but sometimes it has no insertion in the second rib. It is covered by and closely united with the rhomboides.

§ 4. *Serratus Posticus Inferior.*

583. This is a flat thin muscle lying on the lower part of the back. It is fixed in the last spinal apophysis of the back, and in the three first of the loins by a broad aponeurosis. From thence it runs up a little obliquely, and is fixed by fleshy broad digitations in the last four false ribs. Its insertions in the lowest rib is near the cartilage, and in the other three near their angles. It is covered by the latissimus dorsi, to which it adheres very closely, and it covers the sacra-lumbaris and longissimus dorsi.

Situation in general and insertions.

§ 5. *Intercostales.*

584. The intercostal muscles are thin fleshy planes, lying in the interstices between the ribs, their fibres running obliquely from one rib to another. In each interstice lie two planes, an external and an internal, closely joined together, nothing but a thin, fine, cellular, membranous web coming between them.

Situation in general and division.

585. According to this natural division, there must be forty-four intercostal muscles, in the twenty-two interstices left between the twenty-four ribs; and of these there are eleven external,

ternal, and eleven internal on each side. The fibres of the external intercostals run down from behind forward, and those of the internal intercostals from before backward; so that the fibres of these two series of muscles cross each other.

586. The external intercostals extend commonly from the vertebræ to the extremity of the upper labium of the bony portion of each rib, and go no further. The internal begin forward near the sternum, and end backward at the angle of each rib.

587. Therefore, between these angles and the cartilages, these fleshy planes are double, the fibres by their opposite directions representing this kind of figure X. But from the vertebræ to the bony angles, and in the interstices between the cartilaginous portions, the plane is single, being that of the external muscles, backward, and of the internal, forward.

588. The fibres of the external intercostals are very oblique near the vertebræ; but this obliquity decreases insensibly towards the anterior extremities of the ribs. Their insertions begin at the ligaments by which the ribs are fastened to the transverse apophyses. They are a little tendinous, and run a small space beyond the edge, on the outside of each rib.

589. The fibres of the internal intercostals are in general shorter and less oblique than the former. They fill almost entirely the interstices between the cartilaginous portions, and they are covered on the outside by a ligamentary membrane, the fibres of which running in an opposite direction to those of the muscles, have been mistaken for continuations of the external intercostals, over which this membrane is likewise spread, only a little diminished in thickness.

590. Any portion of the breast of an animal may be boiled so much, as that the flesh shall easily part from the bones, and the ribs may be drawn out, disordering neither the muscles nor membranes. But we are not from thence to conclude, that all the intercostals on one side of the thorax make but one muscle, because by the same way of reasoning it might be proved, that all the muscles which immediately surround the Os Femoris are but one, since, by a like experiment, they, together with the periosteum, may be entirely separated from the bone, without breaking their fibres.

§ 6. *Supra-costales.**Situation in general.*

591. These muscles are commonly called *levator costarum*, which name was first given them by Steno, but he did not pretend to have discovered them. They are irregularly triangular, and situated on the back part of the ribs near the vertebræ.

Insertions.

592. Each of these muscles is fixed by one tendinous extremity in the transverse apophysis which lies above the articulation of each rib, and to the neighbouring ligament; the first being inserted in the transverse apophysis of the last vertebra of the neck, and the last, in that of the eleventh vertebra of the back.

593. From thence the fleshy fibres run down obliquely, in creasing in breadth as they descend, and are inserted in the back part of the outside of the following rib. Some of the fibres often pass beyond that rib, and are fixed in one or more of the ribs below it by several digitations, which lie at a greater distance from the vertebræ in proportion as they run lower. In the inferior ribs these digitations are more considerable than in the superior.

§ 7. *Sub-costales.**Situation in general.*

594. These are fleshy planes of different breadths and very thin, situated more or less obliquely on the insides of the ribs near their bony angles, and running in the same direction with the external intercostals.

595. They are fixed by both extremities in the ribs; the inferior extremity being always at a greater distance from the vertebræ than the superior, and several ribs lying between the two insertions.

596. These muscles are more sensible in the lower ribs than in the upper, and they adhere closely to the ribs that lie between their insertions.

§ 8. *Sterno-costales vulgo Triangularis Storni.**Situation in general.*

597. These are five pairs of fleshy planes disposed more or less obliquely on each side of the sternum,

num, on the inside of the cartilages of the second, third, fourth, fifth, and sixth true ribs.

598. They are inserted by one extremity in the edges of the inside of all the lower half of the sternum. *Insertions.* From thence the first muscle on each side runs up obliquely, and is fixed in the cartilage of the second rib. The second runs less obliquely to its insertion in the cartilage of the third rib. The rest are inserted in the same manner in the cartilages of the following ribs; their obliquity decreasing, and their length increasing in proportion as they are situated lower down; so that the lowest is almost transverse.

599. This last muscle which is fixed by one extremity in the cartilage of the sixth true rib near the bone, and seems to pass the appendix ensiformis, immediately above the insertion of the diaphragm in that appendix, and to join the muscle on the other side. The superior portions of the transverse muscles of the abdomen, united with the lowest sterno-costales, have nearly the same appearance, so that these might be reckoned to belong to the transversales, did not the insertion of the diaphragm come between them.

A R T. XIV.

The muscles which move the head on the trunk.

600. **T**HE head has proper motions distinct from those of the neck, and others common to it with the neck. The muscles which serve particularly for these motions are of two kinds, some of them being fixed by one extremity in the head, and the rest having no insertion in that part. *Division.* Those of the first kind are commonly twenty in number, to which four more are added, though they have no insertion in the head.

601. Their number therefore amounts to *Enumeration,* twenty-four, twelve lying on each side, viz.

- | | |
|--|--|
| 1. <i>Sterno-Mastoidæus sive Mastoides Anterior.</i> | 4. <i>Complexus Minor sive Mastoidæus Lateralis.</i> |
| 2. <i>Splenius sive Mastoidæus Posterior.</i> | 5. <i>Rectus Major.</i> |
| 3. <i>Complexus.</i> | 6. <i>Rectus Minor.</i> |

7. *Ob-*

7. *Obliquus Minor five Superior.*
 8. *Obliquus Major five Inferior.*
 9. *Rectus Anticus Longus.*

10. *Rectus Anticus Brevis.*
 11. *Transversalis Anticus Primus.*
 12. *Transversalis Anticus Secundus.*

Situation in general. 602. Of these twelve muscles five are anterior, six posterior, and one lateral.

603. The five anterior, are the sterno-mastoidæus, rectus anticus longus, rectus anticus brevis, transversalis anticus primus, transversalis anticus secundus, which last is not inserted in the head.

604. The six posterior are the splenius, complexus major, rectus major, rectus minor, obliquus superior, obliquus inferior, which last is not fixed in the head. The lateral muscle is the complexus minor.

605. There are besides these, sometimes, small supernumerary muscles, which I shall mention after those to which they belong; and I shall likewise give the reason why I retain the obliquus inferior, and transversalis anticus secundus, though they belong more properly to the neck than to the head.

§ 1. *Sterno-Mastoidæus five Mastoidæus Anterior.*

606. This is a long, narrow, pretty thick, and mostly fleshy muscle, situated obliquely between the back part of the ear, and lower part of the throat. It is in a manner composed of two muscles united at the upper part through their whole breadth, and separated at the lower.

Situation in general and division. 607. It has two insertions below, both of them flat and a little tendinous. The first is in the upper edge of the sternum near the articulation of the clavicula; the other in the clavicula at a small distance from the sternum. These two portions run up obliquely, and unite together at about an inch above their lower insertions, the triangular space left between them being filled by a membrane.

608. The sternal portion passes foremost and covers the clavicular, both forming one body or belly, which running in the same oblique direction to the apophysis mastoidæus, is inserted in the upper and back part of that process; over which

which it likewise sends off a very broad aponeurosis, which covers the splenius, and is inserted in the Os Occipitis.

609. The two anterior mastoidæi represent a great Roman V, the angle being at the lower part of the throat, and the two crura running up behind the ears; as may be plainly seen without dissection.

§ 2. *Splenius sive Mastoideus Posterior.*

610. This is a flat, broad, oblong muscle; situated obliquely between the back part of the ear and the posterior and lower part of the neck. It is partly made up of two portions, one superior, the other inferior. These two portions are closely united backward, making only one plane, but they are divided above.

Situation in general and division.

611. The superior portion is fixed to the extremities of the three or four lowest spinal apophyses of the neck, and of the first, or first and second of the back. It is not fixed immediately to the apophyses of the neck which are above the last, but only by the intervention of the posterior cervical ligament.

612. It is likewise fixed to the edge of the inter-spinal ligaments of the other vertebræ, and therefore its insertions in the spinal apophyses are not interrupted by the distances between these apophyses, but form one thin continued plane a little tendinous.

613. From thence it runs up obliquely toward the mastoid apophysis, partly under the upper extremity of the sternomastoidæus, and is inserted in the upper part of that process, and along the neighbouring curve portion of the transverse ridge of the Os Occipitis.

614. The inferior portion of the splenius is fixed to three or four spinal apophyses of the back, beginning by the second or third. From thence it runs up, being closely united to the other portion, till it reaches the superior and lateral part of the neck, where it separates from it, and is inserted in the transverse apophyses of the three or four superior vertebræ of the neck, by the same number of extremities a little tendinous, which however are sometimes only two in number. This portion of the splenius belongs rather to the neck than to the head.

615. The two splenii represent a great Roman V; and the splenius and sterno-mastoidæus of the same side, form a figure like a Roman A, or the legs of a pair of compasses, the points whereof are in an horizontal plane. Thus these four muscles surrounding the neck, meet alternately at their upper and lower extremities.

§ 3. *Complexus.*

616. This is a pretty long and broad muscle lying on the posterior lateral part of the neck, all the way to the occiput. It is complicated by reason of the decussations of its different portions, from which it has its name, but is commonly looked upon to be one muscle.

Situation in general.
617. It is fixed below by small short tendons to the transverse apophyses of all the vertebræ of the neck except the first, to which it is fixed only near the root of its transverse apophysis. From thence it runs up obliquely backward, crossing under the splenius, and often communicating with it by some fasciculi of fibres.

618. It is afterwards inserted above by a broad fleshy plane in the posterior part of the superior transverse line of the Os Occipitis, near the crista or spine of that bone. At its insertion it joins by one edge the complexus of the other side, and by the other, the splenius which covers it a little.

619. Before we dissect the splenii, we may see in the interstice left between their superior portions, the two complexi united together on the spine of the Os Occipitis.

§ 4. *Complexus Minor sive Mastoidæus Lateralis.*

620. This is a long, slender, narrow, indented muscle, lying along all the side of the neck up to the ear, where it increases a little in breadth. It is something like the complexus major, and Vesalius took it to be a portion of that muscle.

Situation in general.
621. It is fixed by one extremity in all the transverse apophyses of the neck, except the first, by the same number of digitations or branches mostly fleshy and disposed obliquely.

622. From

622. From thence it ascends, and having reached above the transverse apophysis of the first vertebra, it forms a small broad plane, by which it is inserted in the posterior part of the apophysis mastoidæus. It is here covered by the splenius, and covers a little the obliquus superior.

623. This muscle is often mistaken for a portion of the longissimus dorsi.

§ 5. *Rectus Major.*

624. This is a small, flat, short muscle, broad at the upper part and narrow at the lower; and though it is called *rectus*, it is situated obliquely between the occiput and second vertebra of the neck. *Situation in general.*

625. It is fixed below to one branch of the bifurcated spine of the second vertebra of the neck, at a tuberosity which is often found at the upper part of that branch. From thence it ascends a little obliquely outward, and is inserted in the posterior part of the inferior transverse line of the Os Occipitis, at a small distance from the crista, being a little covered by the obliquus superior. *Insertions*

§ 6. *Rectus Minor.*

626. This muscle is like the former, and it has also a small insertion below, in the posterior eminence of the first vertebra. From thence it ascends laterally, and is inserted immediately under the posterior part of the inferior transverse line of the Os Occipitis, in a superficial fossula on one side of the crista occipitalis. *Situation and insertions.*

§ 7. *Obliquus Superior sive Minor.*

627. This muscle is situated laterally between the occiput and first vertebra, being nearly of the same figure with the two recti. It is fixed to the end of the transverse apophysis of the first vertebra; from whence it runs upward and very obliquely backward, and is inserted in the transverse line of the Os Occipitis, almost at an equal distance from the crista and mastoid apophysis. *Situation and insertions.*

physis, between the rectus major and complexus minor, which covers it a little.

§ 8. *Obliquus inferior sive Major.*

628. It is situated in a contrary direction to the obliquus superior, between the first and second vertebra of the neck, resembling that muscle in every thing but the size. It is fixed below to one ramus of the bifurcated spinal apophysis of the second vertebra, near the insertion of the rectus major, from whence it runs obliquely upward and outward, and is inserted in the end of the transverse apophysis of the first vertebra under the lower insertion of the obliquus superior.

Situation in general and insertions.

§ 9. *Rectus Anticus Longus.*

629. This muscle is in some measure of a pyramidal figure, lying along the anterior and lateral parts of the vertebræ of the neck, all the way up to the basis cranii.

630. It is fixed to the anterior parts of the transverse apophysis of the third, fourth, fifth, and sixth vertebræ in a digitated manner. From thence it runs up obliquely inward towards the lateral parts of the bodies of the vertebræ, passes on the foreside of the first and second without being inserted in them, and approaching gradually towards the same muscle on the other side, it is inserted near it, in the forepart of the lower side of the apophysis basilaris, or great apophysis of the Os Occipitis.

Situation in general.

Insertions.

§ 10. *Rectus Anticus Brevis.*

631. This is a small flat muscle, about the breadth of one finger, situated laterally on the anterior part of the body of the first vertebra. It is fixed below to the basis or root of the transverse apophysis of that vertebra, near the anterior eminence.

632. From thence it runs obliquely upward and inward to a transverse impression in the lower side of the apophysis basilaris

Situation and insertions.

filaris of the occipital bone, immediately before the condyle on the same side, being covered by the rectus anticus longus.

§ 11. *Transversalis Anticus Primus.*

633. This is a small, pretty thick, and wholly fleshy muscle, about the breadth of a finger, situated between the basis of the Os Occipitis and the transverse apophysis of the first vertebra. It is fixed by one end in the anterior part of that apophysis; and from thence running up a little obliquely, it is inserted by the other end in a particular impression between the condyle of the Os Occipitis and the mastoide apophysis of the same side, behind the apophysis styloides, and under the edge of the jugular fossula.

*Situation and
insertions.*

§ 12. *Transversalis Anticus Secundus.*

634. This is a small muscle situated between the transverse apophyses of the first two vertebræ of the neck. It is fixed by one extremity very near the middle of the second apophysis, and by the other near the root or basis of the first; and therefore it is a muscle of the neck rather than of the head.

§ 13. *Musculi Accessorii.*

635. We sometimes meet with a small muscle fixed by one end to the extremity of the first transverse apophysis of the neck near the insertions of the two obliqui, from whence, running up obliquely, it is again inserted behind the mastoide apophysis. This muscle is commonly thought to be a third small transversalis on that side where it is found, but it seems rather to be an additional muscle to the obliquus superior. The recti and other obliqui are likewise sometimes found double.

636. I call all these muscles *accessorii* or *supernumerary*, because they are sometimes wanting, and because when they are found, they vary both in number and situation.

ART. XV.

The vertebral muscles in general.

637. **T**HE muscles which lie along the spine, the greatest part whereof serve for the motions of the neck, back, and loins, have by the greatest anatomists been thought very difficult to be well dissected, and clearly described, especially those of the back. All these muscles are very complex, interwoven with each other, and multiplied in various manners, so that it becomes necessary either to make their number much greater than that of the vertebræ, or to reduce them to a small number of long muscles intersected at different places.

638. STENO in order to facilitate the knowledge, dissection and description of these muscles, thought proper to rank them in the following manner. By vertebral muscles he understands those which are fixed in the vertebræ alone; and he distinguishes them all into *recti* and *obliqui*. The *recti* are those which run parallel to the medulla spinalis, or whose direction is longitudinal. The *obliqui* are those which run obliquely between the spinal and transverse apophyses.

639. He divides the *recti* into middle and lateral. The middle *recti* are those which are fixed to the spinal apophyses; the lateral those fixed to the transverse apophyses. He moreover divides all these muscles into simple and compound; the simple being those which are fixed in two vertebræ only; the compound, those fixed in more than two.

640. The *obliqui*, according to him, are of two kinds. Some run up from the transverse to the spinal apophyses, approaching each other; and some run up from the spinal to the transverse apophyses, diverging from each other. The first sort he terms *ad medium vergentes*; the second *a medio recedentes*. These terms are borrowed from optics, and accordingly these two kinds of muscles might be named *converging* and *diverging muscles*. Lastly, he adds, that several muscles of the first kind go from one transverse to several spinal apophyses; and from several transverse to one spinal apophysis.

641. According to this account of the vertebral muscles, the ancient terms *spinales*, *transversales*, and *semi-spinales*, may still

still be applied to them; understanding by *spinales* those muscles which are wholly fixed in the spinal apophyses; by *transversales*, those which are wholly fixed in the transverse apophyses; and by *femi-spinales*, those which are fixed in the spinal apophyses by one extremity only. At present the two kinds of oblique vertebral muscles are better expressed by the two compound terms, *transverso-spinales* and *spino-transversales*.

642. It is however necessary still to retain the general names of *vertebrales recti*, *vertebrales obliqui*, &c. because though the terms already mentioned agree very well to the posterior obliqui, they cannot be applied to the anterior obliqui, one end of which is fixed not in the spinal apophyses, but in the bodies of the vertebræ.

643. The small simple muscles that go only between two vertebræ, may be termed *vertebrales minores*; and the large compound muscles that reach several vertebræ, *vertebrales majores*, both sorts being afterwards divided into *spinales* and *transversales majores* and *minores*. The small muscles are likewise called *inter-spinales* and *inter-transversales*; and as there are some small oblique muscles which cannot be said to reach either the transverse or spinal apophyses, these may be termed simply *inter-vertebrales*.

644. The *transverso-spinales* that go from several transverse to one spinal apophysis are disposed in this manner. The portion that comes from the most transverse apophysis is inserted in the extremity of the spinal apophysis, the portion from the next transverse apophysis is inserted more laterally, and the same rule holds in all the other portions, except in that which comes from the transverse apophysis which is nearest the spinal apophysis.

645. This last portion is not fixed in the spinal apophysis, but rather in its root or basis, and likewise very near the basis of the transverse apophysis, so that it is more properly *inter-vertebralis* than *transverso-spinalis*. Thus in the *transverso-spinales* that go from the ninth, eighth, seventh, and sixth transverse apophyses of the back to the fifth spinal apophysis of the same class, we find that the last and smallest is fixed in the basis of the sixth transverse and of the fifth spinal apophysis.

646. The *transverso-spinales* which go from one transverse to several spinal apophyses, are disposed in this manner. The portion

portion that goes from the basis, or near the basis of the transverse apophysis, is fixed either in or near the basis of the spinal apophysis immediately above it. The next portion, which is more distant from the basis of the transverse apophysis, runs up beyond the next spinal apophysis, and is inserted in that above it, a little further from the basis.

647. The other portions observe the same order, that which comes from the apex of the transverse apophysis being inserted in the apex of the most distant spinal apophysis. From this disposition we see that the most superior vertebral muscles which go from one transverse to several spinal apophyses, are the most inferior of those which go from several transverse to one spinal apophysis.

648. It must be observed, that in speaking of the oblique vertebral muscles, I consider their direction from below upward, and not from above downward, because the inferior vertebræ commonly support those above them, except when a person stands upon his head, with his feet erect, in which case the superior vertebræ sustain the inferior.

649. We ought likewise to remark, that in speaking of these muscles the term *transversalis* is more proper than *transversus*, which last points out a certain direction very different from that which these muscles have; whereas the other marks the relation which they have to the transverse apophyses.

650. Besides the *vertebral muscles* properly so called, several other muscles not inserted wholly in the vertebræ, serve to move them. Some of the ancients called these *semi-spinales*, to distinguish them from those they termed *spinales*, which included all the vertebral muscles; and therefore as we have termed these *vertebrales*, the others may be named *semi-vertebrales*.

651. Among the *vertebrales* properly so called, some, from their insertions, seem to be common to the neck and the back, some to the back and loins; but, for distinction's sake, I reckon among those of the neck, not only the muscles entirely fixed in the vertebræ thereof, but also those whose superior insertion is in the seventh vertebræ of the neck, though all their other insertions be in those of the back; and I observe the same method with respect to the loins.

652. All these muscles vary very much in their insertions and reciprocal communications; by which last they are often so much

much confounded together, that it is a very difficult matter to distinguish them, for those who are not previously acquainted with them. In general, they are more easily distinguished in children than in adults, and in adults than in very aged persons.

653. In describing these muscles I confine myself chiefly to what I have most commonly observed myself; without pretending to contract or discredit what other very great anatomists have published about them.

A R T. XVI.

The vertebral muscles in particular.

654. **T**HE muscles that move the neck in particular, are very many in number, as has been already observed in speaking of the vertebral muscles in general; but in order to shun all confusion, and easily to form an idea of them, they may be taken collectively, and thereby be reduced to twelve, six on each side, of which one is situated on the foreside of the neck, the rest on the backside. *Muscles of the neck.*

655. The muscle, which with its fellow lies on the foreside of the neck, is named,

1. *Longus Colli.*

656. Those on the backside are,

- | | |
|---|---|
| 2. <i>Transversalis Colli Major.</i> | 5. <i>Spinales Colli parvi sive Inter-spinales.</i> |
| 3. <i>Transversalis Gracilis sive Collateralis Colli.</i> | 6. <i>Transversales Colli Minores sive Inter-transversales.</i> |
| 4. <i>Semi spinalis sive Transverso spinalis Colli.</i> | |

657. The *spinales minores* and *transversales minores* are here reckoned collectively; for if we take them separately, there are six or seven of each sort on each side of the neck; neither is the number of them always the same. The *transversalis gracilis* has often been looked upon as a portion of that long muscular mass termed *longissimus dorsi*. It has likewise been taken by some for the *cervicales descendens* of

Diemerbroeck, and by others it has been called *Accessorius Stenonis*.

658. We ought likewise to reckon among the muscles of the neck, two of which have been described among those of the head, viz.

7. *Obliquus Major.*

8. *Rectus Minor.*

659. I do not speak here of other muscles which assist in moving the neck, that is, all those that move the head, except the small ones inserted in the cranium, and in the first vertebra of the neck.

§ 1. *Longus Colli.*

660. This vertebral muscle is made up of several others, situated laterally along the fore-side of all the vertebræ of the neck, and some of the upper vertebræ of the back.

661. It may be divided into two portions, one superior, consisting of oblique converging muscles, and one inferior, composed of oblique diverging muscles.

662. The superior portion is covered by the rectus anticus longus of the head. The muscles, of which it consists, are fixed below to all the transverse apophyses that lie between the first vertebra and the last. From thence they run up obliquely, and are inserted in the anterior eminence of the first vertebra, and in the bodies of the three following. The insertion in the eminence is so closely united to the ligament which goes to the Os Occipitis, that it can hardly be distinguished from it.

663. The inferior portion appears almost straight, and yet all the muscles that compose it are diverging, or directed obliquely outward. They are fixed below, to the anterior lateral part of the body of the last vertebra of the neck, and of the first three of the back, and sometimes of more. From thence they run upward and a little obliquely outward and are inserted near the transverse apophyses of all the vertebræ of the neck, except the first and last.

664. Though these two portions seem to be confounded with each other, they may nevertheless be easily distinguished by an oblique line that runs between them from the transverse apophysis of the second vertebra to the body of the sixth.

665. The

665. All the insertions of this muscle are more or less tendinous.

§ 2. *Transversalis Colli Major.*

666. This is a long thin muscle, placed along all the transverse apophyses of the neck, and the four, five, or six upper apophyses of the back, between the complexus major and minor, lying, as it were, on the insertions of the first of these muscles.

Situation in general.

667. It is composed of small muscular fasciculi, which run directly from one or more transverse apophyses, and are inserted sometimes in the apophysis nearest to these, sometimes in others more remote, the several fasciculi crossing each other between the insertions of the two complexi, which are likewise crossed by them. They have sometimes a communication with the longissimus dorsi, but this is not uniform.

Insertions.

§ 3. *Transversalis Gracilis sive Collateralis Colli.*

668. This is a long thin muscle, resembling the transversalis major in every thing but size, and situated on the side of that muscle. It is commonly taken for a portion or continuation of the sacro-lumbaris. Diemerbroek distinguished it by the name of *cervicalis descendens*; and Steno, and others after him, have called it *accessorius musculus sacro-lumbaris*, in speaking of which muscle I shall have occasion to mention it again.

§ 4. *Semi-Spinalis sive Transverso-Spinalis Colli.*

669. This name is given to all that fleshy mass which lies between the transverse and spinal apophyses from the second vertebra of the neck to the middle of the back; the splenius and complexus major which cover it, having been raised.

Situation.

670. It is composed of several oblique converging muscles, which may be divided into external and internal, and of these the external are the longest.

Division.

671. The external are fixed below, to the transverse apophyses of the six, seven, eight, or nine upper vertebræ of

the back, by tendinous extremities, which, as they ascend, become fleshy, and mix with each other. Their superior insertions in the neck, are six in number, whereof the first, which is tendinous, is in the seventh spinal apophysis; the rest, which are fleshy, are in the five next spinal apophyses.

672. The lowest of these external muscles mix more or less by some communicating fleshy fibres, with the spinalis, longissimus, and semi-spinalis dorso.

973. The internal are shorter and more oblique than the external, and partly covered by them. They are fixed by their lower extremities to the transverse apophyses of the three or four upper vertebræ of the back and to the oblique apophyses of the four or five lower vertebræ of the neck; and by their other extremities they are inserted in the six spinal apophyses of the neck.

674. Some of these internal muscles are very short, lying wholly between the spinal apophyses and the oblique or transverse apophyses next them.

§ 5. *Spinales Colli Minores.*

675. These muscles lie between the six spinal apophyses of the neck, and between the last of the neck and first of the back, being inserted in these apophyses by both extremities on one side of the posterior cervical ligament, which parts them from those on the other side. They are likewise termed *inter-spinales*.

Situation and insertions.

§ 6. *Transversales Colli Minores.*

676. These are very small short muscles, found in the interstices of several transverse apophyses in which they are inserted. They are likewise termed *inter-transversales*.

677. The muscles which move the vertebræ of the back and loins would amount to a much greater number, and be much more difficult to conceive than those of the neck, were they to be reckoned separately as vertebral or semi-vertebral muscles. It is therefore proper to reduce them to a collective number, which may conveniently enough be fixed to twenty-four, twelve on each side, viz.

Muscles of the back, loins, and Os Coccygis.

- | | |
|--|--|
| 1. <i>Sacro-Lumbaris.</i> | 8. <i>Semi-Spinalis sive Transver-</i> |
| 2. <i>Longissimus Dorsi.</i> | <i>so Spinalis Lumborum, Sa-</i> |
| 3. <i>Spinalis Dorsi Major.</i> | <i>cer Veterum.</i> |
| 4. <i>Spinales Dorsi Minores.</i> | 9. 10. <i>Spinales & Transver-</i> |
| 5. <i>Transversalis Dorsi Major.</i> | <i>sales Lumborum.</i> |
| 6. <i>Transversales Dorsi Minores.</i> | 11. <i>Quadratus Lumborum sive</i> |
| 7. <i>Semi Spinalis sive Transver-</i> | <i>Lumbaris Externus.</i> |
| <i>so Spinalis Dorsi.</i> | 12. <i>Coccygæi.</i> |

678. The vertebræ of the back, and especially those of the loins, may likewise be moved by the muscles of the abdomen, as has been already observed. The inferior portion of the longus colli may contribute something to the motion of the upper vertebræ of the back; the psoas to that of the vertebræ of the loins, and the glutæus maximus to that of the Os Coccygis,

§ 7. *Sacro-lumbaris.*

679. This is a long complex muscle, narrow, and thin at the upper part, broad and thick at the lower, representing a kind of flat pyramid.

Situation and name.

It lies between the spine and posterior part of all the ribs, and along the back-part of the regio lumbaris, all the way to the Os Sacrum.

680. Through all this space it is closely accompanied by the longissimus dorsi, which lies between it and the spinal apophyses of the vertebræ, a narrow, fatty, or cellular line running between them. The name of *lumbo-costalis* would better express the situation of this muscle than that of the sacro-lumbaris. It might be termed *medius dorsi*, to distinguish it from the latissimus and longissimus dorsi, between which it is placed.

681. It is fixed below by a broad thin tendinous aponeurosis to the superior spines of the Os Sacrum, and to the neighbouring lateral parts of that bone; and lastly, to the external labium of the posterior part of the crista Ossis Ilium, all the way to the great tuberosity. The aponeurosis covers and adheres very closely to the lower part of the longissimus dorsi; and where it is fixed to the Os Sacrum, it is a little covered by some insertions of the glutæus maximus.

Insertions.

682. From thence this muscle runs upward and a little laterally,

laterally, over all the regio lumbaris, the aponeurosis sending off from its inside a mass of fleshy fibres, which are divided from below upwards, into several large fasciculi inserted in all the transverse apophyses of the loins.

683. Afterwards it runs up obliquely over all the ribs, sometimes as high as the two or three lowest vertebræ of the neck, sometimes higher, and sometimes it ends at the first vertebra of the back.

684. Through all this extent the side of the muscle next the longissimus dorsi or vertebræ, is very even; but that next the ribs is divided into several portions in an oblique disposition from below upwards, resembling in some measure the branch of a palm-tree. These portions or digitations, are fixed in the transverse apophyses of the neck, in the tuberosity of the first rib, in the lower part of the angular impressions of the ten following ribs, and near the extremity of the last rib.

685. This digitation belonging to the last rib is broad and more fleshy than tendinous. Those of the other ribs are tendinous, flat, and narrow, and those of the neck are something fleshy, but very slender. The most superior portions are longer and narrower than those below them, they growing gradually shorter and broader as they descend.

686. In dissecting this muscle with care, between these portions and the ribs, we meet with several long thin muscular fasciculi, which crossing the portions and adhering to them, are afterwards fixed in the ribs above and behind the insertions of the several portions.

687. These muscular fasciculi begin at the transverse apophyses of the same vertebræ of the neck, from whence they run down, and are fixed in the eight or nine following ribs. Sometimes they pass over several ribs without being inserted in them; but this varies in different subjects, and sometimes in the two sides of the same subject.

688. In this manner these fasciculi form a particular plane, which some take for the internal portion of the sacro-lumbaris; others, after Steno, call it *musculus accessorius sacro-lumbaris*. Some take it for a distinct muscle, calling it the *cervicalis descendens* of Diemerbroek. I have already mentioned it among the muscles which move the vertebræ of the neck, by the name of *transversalis gracilis colli*.

§ 8. *Longissimus Dorfi.*

689. This is a very complex, long, and narrow muscle, something like the sacro-lumbaris, but more fleshy and thicker, situated between the spinal apophyses and the muscle just mentioned, from which it is divided by a small, fatty, or cellular line, but at the lower part they are confounded together. It covers the semi-spinalis or transverso-spinalis dorfi and the semi-spinalis lumborum. Its upper part lies between the sacro-lumbaris and transversalis colli.

Situation in general.

690. Its inferior insertions are partly by distinct tendinous portions, and by a broad aponeurosis common to it with the sacro-lumbaris, and partly by large fasci- culi of fleshy fibres, which at first sight seem to compose one uniform mass. It is fixed by the long, flat, tendinous portions, of different breadths, to the last spinal apophysis of the back, to all those of the loins, and to one or two of the superior spines of the Os Sacrum. These portions lie at different distances from each other, but are all connected by a thin aponeurosis fixed to their edges.

Insertions.

691. From thence they run up obliquely, diverging from the apophyses, and beginning to be fleshy at their inner or anterior sides, they terminate above in small roundish tendons, inserted in the extremities of the seven upper transverse apophyses of the back, and in the neighbouring ligaments of all the true ribs. Sometimes one insertion in the vertebræ of the back is wanting, and sometimes there is one in the transverse apophysis of the last vertebra of the neck.

692. The other inferior insertion wholly fleshy, is partly in the inner or fore-side of the aponeurosis of the sacro-lumbaris, and partly in the upper portion of the Os Sacrum, being from thence continued to the great tuberosity of the Os Ilium, so that the aponeurosis of the sacro-lumbaris seems to afford a third insertion to the longissimus dorfi.

693. From thence this uniform mass of fleshy fibres runs up in a course almost direct, crossing the tendinous portions which are more oblique; and join the inferior fibres of the sacro-lumbaris by large fasciculi inserted in the transverse and oblique apophyses of the vertebræ of the loins. The fibres

of

of this portion go afterwards to the ribs, being inserted by planes more or less fleshy, in the lower convex edge of all the false ribs, between the condyles or tuberosities and the angles.

694. At the sixth or seventh vertebra of the back, one or more of the tendinous portions often communicate with some fasciculi of the semi-spinalis or transverso-spinalis dorsi.

695. By this description we see that the longissimus dorsi is in part a great semi-spinalis divergens or spino-transversalis, much in the same manner as the inferior portion of the splenius.

696. In examining the dorsal insertions of this muscle, we meet with several muscular fasciculi which cross the tendinous portions near the spine, but without adhering so strongly to them as those already mentioned do to the sacro-lumbaris, which they resemble in every other circumstance. These fasciculi are fixed above, to the transverse apophyses of the three or four first vertebræ of the back, and below to those of the sixth and seventh.

697. I have observed other such fasciculi fixed in the transverse apophyses of the back from the first to the ninth inclusively, and situated between the extremities of the transversalis major colli, and of the longissimus dorsi with which they communicate at the third vertebra or thereabouts.

698. These fasciculi might be reckoned a musculus accessorius longissimi dorsi, or a transversalis dorsi, in the same manner as that of the sacro-lumbaris already mentioned.

699. Some anatomists imagine that the longissimus dorsi is continued all the way to the apophysis mastoidæa of the cranium, taking the complexus minor or mastoidæus lateralis to be a portion of this muscle.

700. This muscle and the sacro-lumbaris are common to the back and loins.

§ 6. *Spinalis Dorsi Major.*

Situation in general. 701. This is a pretty long and slender muscle, lying upon the lateral part of the extremities of the spinal apophyses of the back.

702. It is composed of several muscular fasciculi of different

rent lengths, which crossing each other, are inserted laterally by small tendons in the spinal apophyses from the second, third, or fourth vertebra of the back, and sometimes, though seldom, from the last of the neck or first of the back; all the way to the first or second vertebra of the loins, with several irregular decussations which vary in different subjects.

Insertions.

703. The longest fasciculi are a little incurvated, because they inclose the rest, which are gradually disposed between the long ones and the spinal apophyses; so that this muscle which terminates by both extremities in points, is of some considerable breadth in the middle.

704. It communicates by some fibres with the longissimus dorsi and semi-spinalis or transverso-spinalis; and it sends off fasciculi to several transverse apophyses of the back from the fourth to the eleventh.

705. It is commonly named *semi-spinalis*, but very improperly, as appears from what has been said about the vertebral muscles in general.

§ 10. *Spinales Dorfi Minores.*

706. These muscles are of two kinds. Some go laterally from the extremity of one spinal apophysis to another; being often mixed with the short fasciculi of the spinalis major. The rest lie directly between the extremities of two neighbouring spinal apophyses, being separated from their fellows on the other side, by the spinal ligament. They are smaller and thinner than those of the neck, and are properly enough termed *inter-spinales*.

Division and insertions.

§ 11. *Transversalis Dorfi Major.*

707. This muscle was described together with the longissimus dorsi.

§ 12. *Transversales Dorfi Minores.*

708. I have found some particular muscles of this kind fixed to the extremities of the three lowest transverse apophyses of the back. The rest are all in some measure continuations of the transversalis major; but these few which are dis-

ting, and which lie in the interstice between two apophyses, may justly enough be termed *inter-transversales*.

§ 13. *Semi-spinalis sive Transverso-spinalis Dorsi.*

Situation in general.

709. This is a fleshy mass, which, from all the spinal and transverse apophyses of the back and loins, is extended in distinct fasciculi over the vertebræ themselves.

719. It is made up like that of the neck, of several oblique converging vertebral muscles, the uppermost of which is fixed below, to the third transverse apophysis of the back, and above to the first spinal apophysis. The lowest is fixed below, to the third transverse apophysis of the loins, and above to the last spinal apophysis of the back.

711. They may be divided into external, which are first discovered, and internal, which lie immediately on the vertebræ. The external from the first vertebra to the seventh, inclusively, appear to be longer than the internal, which are covered by them. They may likewise be distinguished into those which go from one transverse to several spinal apophyses, and those which go from several transverse to one spinal apophysis.

§ 14. *Transverso-spinalis Lumborum, Sacer Veteribus.*

712. This muscle is composed of several oblique converging or transverso spinal muscles in the same manner as in the back and neck; and it lies between the spinal and oblique apophyses of the loins, reaching to the Os Sacrum.

713. The lowest of these muscles are fixed to the superior lateral parts of the Os Sacrum, to the ligamentum sacro-iliacum, and to the posterior superior spine of the Os Ilium. The rest are fixed to the three lowest transverse apophyses, and to the four lowest oblique apophyses of the loins, and to their lateral tuberosities. From thence they run up to all the spinal apophyses of these vertebræ, the external, or those that appear first, being longer than the internal, which lie immediately on the vertebræ, especially toward the lower part.

§ 15. *Spinales & Transversales Lumborum*

714. There are some fasciculi which run up from the superior false spines of the Os Sacrum, to the lower spinal apophyses of the loins, which may be looked upon as so many *spinales lumborum majores*. There are likewise some *spinales minores* between the spinal apophyses of the loins, and *transversales minores* between the transverse apophyses, which are sometimes of a considerable breadth.

§ 16. *Quadratus Lumborum five Lumbaris Externus.*

715. This is a small, oblong, flat muscle, irregularly square, narrower at its upper than at its lower part, lying along the sides of the *Situation in general.* *vertebræ lumborum* between the last false rib and the Os Ilium.

716. It is fixed below to the external labium of almost all the posterior half of the crista Offis Ilium, to the ligamentum sacro-iliacum, and a little to the Os Sacrum, by a fleshy plane, the fibres whereof run obliquely backward. *Insertions.*

717. From thence it runs up between the sacro-lumbaris and psoas, by both which it is partly hid, and is inserted in the extremities of all the transverse apophyses of the loins by oblique tendinous digitations. It is likewise fixed by a broad insertion in the twelfth rib, on the inside of the ligament that lies between it and the longissimus dorsi, by which that rib is connected to the first vertebra of the loins.

718. I have observed likewise a small lumbaris externus adhering very closely to the backside of the quadratus, and fixed by tendinous digitations to the extremities of the second, third, and fourth transverse apophyses of the loins. From thence its fleshy fibres run up obliquely over the quadratus, and then mix with it at its insertion in the last false rib.

§ 17. *Musculi Offis Coccygis.*

719. These are small, thin, radiated muscles lying on the inner

inner or concave side of the Os Sacrum, and neighbouring parts of the pelvis. They are four in number, two on each side, whereof one is placed more forward, the other more backward; for which reason the first may be termed *coccygæus anterior sive ischio-coccygæus*; the other *coccygæus posterior sive sacro-coccygæus*.

720. The *coccygæus anterior* is fixed by a broad insertion in the anterior portion of the small transverse ligament at the upper part of the foramen ovale of the Os Innominatum, which, as was observed in the description of the fresh bones, is no more than a particular fold of the great transverse ligament of the pelvis. From thence it runs between this great ligament and the musculus obturator internus, with which it is often confounded by anatomists, and contracting in breadth, it is inserted in the lower part of the Os Coccygis.

721. The *coccygæus posterior*, or *sacro-coccygæus*, is fixed to the inner or concave edge of the two first vertebræ of the Os Sacrum, to the inner and lower edge of the ligamentum sacro-sciaticum, and to the spine of the Os Ischium. From thence contracting in breadth, it is inserted in the inside of the Os Coccygis above the former muscle.

§ 18. *Psoas Parvus*.

722. This is a long slender muscle lying upon the *psoas major*. It is sometimes wanting; and Riolan, who met with it often in men, takes notice of his having found it once in a woman, as a thing very extraordinary. As for my own part, I found it several times in women before I ever met with it in men, and I still continue to observe it most frequently in that sex.

723. It is fixed above by a short tendon, sometimes to the last transverse apophysis of the back, or higher; sometimes to the first of the loins, and sometimes to both. From thence it runs down wholly fleshy, and more or less complex, on the great *psoas* in a direction a little oblique.

724. Having reached the middle of the regio-lumbaris or thereabouts, it forms a slender flat tendon, which gradually increasing in breadth, like a thin aponeurosis, runs over the *psoas major* and *iliacus internus* at their union, and from thence down to the symphysis of the Os Pubis and Os Ilium,

and

and is inserted chiefly in the crista of the Os Pubis above the insertion of the pectineus, sometimes sending an aponeurotic lamina further down.

725. Besides this psoas parvus, there is another still smaller, between it and the vertebræ, inserted much in the same manner. This muscle I discovered in the year 1713.

A R T. XVII.

The muscles which move the lower jaw.

726. **T**Hese muscles are ten in number, five on each side, viz.

- | | |
|---|------------------------------|
| 1. <i>Masseter.</i> | 4. <i>Pterygoideus Minor</i> |
| 2. <i>Temporalis,</i> | <i>sive Externus.</i> |
| 3. <i>Pterygoideus Major sive Internus.</i> | 5. <i>Digastricus.</i> |

727. To these some add the two musculi cutanei; but very improperly, for a reason which shall be given in another place.

§ 1. *Masseter.*

728. This is a very thick fleshy muscle, situated at the back part of the cheek. It seems to be made up of three portions, like a triceps, viz. one large and external portion, one middle, and one small and internal. *Situation.*

729. The external portion is fixed by one tendinous extremity to all the inferior edge of the Os Malæ. and a little to the neighbouring parts of the Os Maxillare and apophysis zygomatica of the Os Temporum. From thence it runs down obliquely backward, being wholly fleshy, and is inserted by the other extremity in the rough impression on the outside of the angle of the lower jaw.

730. The middle portion is fixed by one end to the lower edge of the whole apophysis zygomatica of the Os Temporum, and a very little to that of the Os Malæ. From thence it runs down a little obliquely forward in an opposite direction to the first portion, under which it crosses; and is inserted by its other extremity in the middle of the inside of the ramus of

of the lower jaw, near the insertion of the external portion with which it mixes.

731. The third portion which is least and most internal, is fixed by one extremity to the inner labium of the lower edge, and also to the inside of almost all the zygomatic arch; and by the other, to the root or basis of the coronide apophysis, where it mixes wholly fleshy with the insertion of the middle portion. This third portion, by its nearness of situation, seems sometimes to be an appendix of the temporal muscle.

§ 2. *Temporalis.*

732. This is a broad flat muscle, resembling the quadrant of a circle in figure. It occupies all the semi-circular or semi-oval plane of the lateral region of the cranium, the temporal fossa, and part of the zygomatic fossa. From this situation it has its name, and likewise that of *crotaphites*, which is sometimes given to it.

733. To conceive justly the insertions of this muscle, it must be observed, that through all the circumference of the semi-circular plane already mentioned, the pericranium is divided into two laminae. The internal lamina sometimes taken for a particular periosteum, covers immediately all the bony parts of this region. The external lamina separated from the other, is spread out like an aponeurotic or ligamentary tent, by means of its adhesions to the external angular apophysis of the *Os Frontis*, to the posterior edge of the superior apophysis of the *Os Malæ*, and to the upper edge of all the zygomatic arch, all the way to the root of the mastoide apophysis.

734. This muscle is composed of two planes of fleshy fibres, fixed to the two sides of a tendinous plane nearly of the same breadth with them, it being spread quite through the muscle like a concealed middle tendon; as may be plainly seen by dividing the muscle all the way to the bone, according to the direction of its fibres. The body of the muscle thus formed is inclosed between the two aponeurotic or ligamentary laminae in the following manner.

735. The internal fleshy plane is fixed by a broad radiated insertion, to all the semicircular plane of the cranium, by the intervention of the internal lamina of the periosteum.

736. Thus

736. Thus it is fixed to the lateral external part of the Os Frontis, and to its external angular apophysis, to the lower part of the Os Parietale, to the squamous portion of the Os Temporis, to the great ala or temporal apophysis of the sphenoidal bone, by which the temporal fossa is formed; and a little to the backside of the internal orbitary apophysis of the Os Malæ which forms part of the zygomatic fossa.

737. Through all this space the fleshy fibres contract gradually, by means of their adhesions to the tendinous plane, which diminishes in breadth and increases in thickness in proportion as it descends.

738. The external fleshy plane is fixed in the same radiated manner to the inside of the external lamina of the pericranium, from the great semicircular circumference, all the way to a small portion of this lamina, more or less semicircular, above its insertion in the zygomatic arch. Here the fleshy fibres leave the external lamina, and the void space thus formed between the small semicircular portion, and the fleshy fibres, is commonly filled with fat.

739. Through the whole extent of this insertion the fleshy fibres gradually contract, and adhere to the outside of the middle tendinous plane in the same manner as the internal plane adheres to the other side, but in a contrary direction.

740. The middle tendinous plane continuing to contract by degrees, ends at length in a very considerable tendon, the extremity whereof, which is in a manner double, incloses the coronoide apophysis of the lower jaw, being strongly inserted in the edges and inside thereof, and also a little in that part of the bone which lies between the two apophyses. The internal portion of this insertion is thicker, and has more fleshy fibres than the external, which is almost wholly tendinous or aponeurotic.

741. There is another small plane reckoned by some to be a portion of this muscle, which in reality is no more than the third portion of this masseter, as may easily be perceived by sawing off the zygomatic arch at the two ends, and then turning it down; for this small muscle parts from the temporalis without difficulty, and continues to adhere to the masseter.

§ 3. *Pterygoideus Major five Internus.**Situation in general.*

742. This muscle lies on the inside of the lower jaw almost in the same manner as the masseter does on the outside, being of the same figure with that muscle, only smaller and narrower.

Insertions.

743. It is fixed above in the pterygoide cavity, chiefly to the inside of the external ala of the apophysis pterygoide. This insertion is wholly fleshy, and from thence the muscle has its name.

744. It runs down obliquely toward the angle of the lower jaw, and is inserted a little tendinous in the inequalities on the inside thereof, opposite to the insertion of the masseter. It might be called *masseter internus*.

§ 4. *Pterygoideus Minor five Externus.**Situation in general.*

745. This is an oblong fleshy muscle, much smaller than the other, and situated almost horizontally between the outside of the apophysis pterygoide, and the condyloide apophysis of the lower jaw, the subject being considered in an erect posture.

746. It is fixed by one extremity to the outside and edge of the outer ala of the pterygoide apophysis, filling the fossula which is at the basis of this apophysis, near the basis of the temporal apophysis; of the sphenoidal bone.

747. From thence it runs backward and a little outward, into the void space between the two apophyses of the lower jaw, and is inserted interiorly in the condyloide apophysis, at a small fossula immediately under the inner angle of the condyle. It is also fixed to the capsular ligament of the joint.

§ 5. *Digastricus.**Situation in general.*

748. This is a small long muscle, situated laterally between the whole basis of the jaw and the throat. It is fleshy at both extremities and tendinous in the middle, as if it consisted of two small muscles joined

joined endwise by a tendon, and from thence it is called *digastricus* in Greek, and *biventer* in Latin.

749. It is fixed by one fleshy extremity in the sulcus of the mastoide apophysis. From thence it runs forward, inclining towards the Os Hyoides, where *Insertions.* the first fleshy body ends in a round tendon, which is connected to the lateral part and root of the cornua of that bone by a kind of aponeurotic ligament, and not by a vagina or pulley, as appears at first sight, because of its passage by the extremity of the *musculus styloglossus*, of which hereafter.

750. Here the tendon is incurvated, and presently ends in the other fleshy body, which is fixed immediately above the internal labium of the basis of the chin near the symphysis, in a small unequal depression. This insertion is broader than that of the other extremity. Sometimes the anterior insertions of the two *digastrici* touch each other, and sometimes several of their fibres cross each other considerably.

A R T. XVIII.

The muscles which move the Os Hyoides.

751. **T**HESE muscles are nine in number, one anterior without a fellow, and eight lateral disposed in four pairs, viz.

1. *Mylo-Hyoidæus.*

4. *Omoplato-Hyoidæus.*

2. *Genio-Hyoidæus.*

5. *Sterno-Hyoidæus.*

3. *Stylo-Hyoidæus.*

752. These names are borrowed from the Greek, and express the parts in which the muscles are inserted.

753. The Os Hyoides is likewise moved by the *digastricus* of the lower jaw; and it may in certain circumstances be moved a little by some other muscles, of which hereafter.

§ 1. *Mylo-Hyoidæus.*

754. This is a broad, thin, penniform muscle, *Situation in general.* situated transversely between the internal lateral parts

parts of the basis of the lower jaw, and lying on the anterior portions of the two digastric muscles.

755. It is made up of two equal fleshy portions, one lying on the right side, the other on the left, both in the same plane, and joined to a small middle tendon, which is inserted anteriorly in the middle of the basis of the Os Hyoides, and from thence runs directly forward, diminishing gradually in its course. This is therefore a true digastric muscle, and cannot be divided into two.

756. Each portion is fixed by fleshy fibres to the internal lateral part of the lower jaw, between the oblique prominent line and the basis, under the first four dentes molares, and caninus. The anterior and the greatest part of the other fibres of each portion run obliquely from before backward, to the middle tendon, in which they are regularly fixed, the anterior fibres being the shortest, and a small triangular void space being formed between them, and the symphysis of the chin.

757. The posterior fibres of each portion which make about a fourth part of the whole, run likewise on each side to the basis of the Os Hyoides, and are inserted along the lower edge of its anterior or convex side, and from thence a little upward.

§ 2. Genio-Hyoidæus.

Situation in general. 758. This is a small and pretty long fleshy muscle, situated between the symphysis of the chin and the Os Hyoides, close by its fellow.

Insertions. 759. It is fixed by its anterior extremity to a rough and sometimes prominent surface, on the inner or posterior side of the symphysis of the lower jaw, a little above the chin. From thence it runs backward, and is inserted anteriorly in the upper edge of the basis of the Os Hyoides, having first sent off a small lateral portion which is fixed a little higher to the root of the cornu.

760. This portion is distinguished from the rest by a nerve of the ninth pair; and it makes the muscle appear a little oblique. The two genio-hyoidæi lie very close together, except

cept at their upper edge, where they are a little separated, but every where else they look as if they were but one muscle.

§ 3. *Stylo-Hyoidæus.*

761. This is a small fleshy muscle, lying obliquely between the apophysis styloides and Os Hyoides. *Situation in general.*

762. It is fixed laterally by one extremity to the root or basis of the apophysis styloides, and by the other to the Os Hyoides, at the place where the basis and cornu unite, and likewise to the cornu itself, from whence it has been called *stylo-cerato hyoidæus*. *Insertions.*

763. The fleshy fibres of this extremity are often parted, and inclose the middle tendon of the digastricus.

§ 4. *Omo-plato-Hyoidæus* five *Omo-Hyoidæus* vulgo *Coraco-Hyoidæus*.

764. This is a very long small muscle, much narrower than the sterno-hyoidæus, and situated obliquely on the side of the neck or throat, between the scapula and Os Hyoides. It is a digastric muscle, being divided into two fleshy portions joined endwise to a short middle tendon. *Situation in general.*

765. It is commonly fixed by the lower extremity, to the superior costa of the scapula, between the small notch and the angle, and sometimes very near the angle, and from thence some anatomists have given it the barbarous name of *costo-hyoidæus*. *Insertions.*

766. From thence it passes over the coracoid apophysis, adhering sometimes to it by a kind of aponeurosis or membranous ligament, and from this adhesion the name of *coraco-hyoidæus* was given it by some who had not discovered its main insertion.

767. It is likewise often fixed to the clavicle by ligamentary or fleshy fibres; and I have sometimes seen it inserted in the whole middle portion of that bone, being inseparably united with the sterno-hyoidæus. In one subject I found it to be a kind of biceps, one portion of it being fixed to the angle of the scapula, the other to the extremity of the clavicle.

768. Having passed the clavicle, it is bent forward, and runs between the sterno-mastoidæus, and internal jugular vein, the small middle tendon being situated in this place. From thence it runs up to its insertion in the inferior lateral part of the basis of the Os Hyoides, near the cornu, and insertion of the sterno-hyoidæus which it covers a little.

§ 5. *Sterna-Hyoidæus five Sterno-Cleido-Hyoidæus.*

Situation in general. 769. This is a long, thin, flat muscle, broader at the lower than at the upper part, and situated, together with its fellow, on the foreside of the throat, from whence some have very improperly termed it *musculus bronchialis*.

Insertions. 770. It is fixed by its lower extremity, in the superior and lateral part of the inner or posterior side of the sternum, in the posterior part of the sternal extremity of the clavícula, in the transverse ligament which connects these two bones, and in the inner or backside of the cartilage of the first rib. All these other insertions are more considerable than that in the sternum, which is sometimes scarce perceivable.

771. From thence it runs up on the foreside of the aspera arteria, joined to its fellow by a membrane which forms a sort of linea alba, and is inserted laterally in the lower edge of the basis of the Os Hyoides.

772. There is sometimes a transverse tendinous line about the middle of the backside of this muscle.

773. According to the method commonly observed in complete treatises of myology, the following muscles remain still to be described, *viz.* The muscles of the forehead, occiput, palpebræ, eye, external ear, nose, lips, tongue, uvula, ductus Eustachianus, pharynx, larynx, parts of generation, anus, and bladder; and to these we ought even to add the heart, as Mr. Cowper has done in the late edition of his *Myotomy*.

774. This method may be followed in treatises on the muscles alone, in which all the parts that have any relation to them, are supposed to be known. But in a complete system of anatomy, it is neither proper for beginners, nor even for those who believe they have made a considerable progress in this

this science. For such a treatise of all the muscles of the body must be placed either before the description of the viscera and other particular organs, or after it.

775. If it goes before, we must be obliged to speak of many parts altogether unknown, and thereby occasion false ideas and dangerous mistakes. If it comes after, the inconveniency will be equally great, it being impossible to give any true idea of many of the viscera without a previous knowledge of the muscles that lie near them; neither can the learner be made acquainted with these muscles, till he knows the bones, cartilages, &c. which sustain and surround them, as we shall see afterwards.

776. It may be objected, that I have here described the palmaris brevis, which is inserted in no bone, and that I have omitted the muscles of the bones of the ear, which are entirely fixed in bones. I have already answered the first objection, and the second shall be answered in the proper place.

A R T. XIX.

A compendious view of all the muscles which are wholly inserted in bones; with an enumeration of the bones in which each muscle is inserted.

1. *Obliquus Externus.* **T**HE fifth, sixth, and seventh true ribs; seldom the fourth. All the false ribs. The Os Ilium. The Os Pubis.

Muscles of the abdomen.

2. *Obliquus Internus.* The sixth and seventh true ribs, and their cartilages. All the false ribs and their cartilages. The last vertebra of the loins. The Os Ilium. The Os Pubis.

3. *Transversalis.* The cartilages of the sixth and seventh true ribs. The cartilages of all the false ribs. The three first vertebræ of the loins.

4. *Rectus.* The extremity of the body or second bone of the sternum. The cartilages of the fifth, sixth, and seventh true ribs. The cartilage of the first false rib. The Os Pubis.

5. *Pyramidalis.* The Os Pubis.

6. *Trapezius.*

6. *Trapezius*. The Os Occipitis. The spinal apophyses of all the vertebræ of the neck. The spinal apophyses of all the vertebræ of the back. The scapula; its spine and acromium. The clavicle; its humeral portion.

Muscles which move the bones of the shoulder on the trunk.

7. *Rhomboidei*. The two or three lowest vertebræ of the neck; their spinal apophyses. The three or four upper vertebræ of the back; their spinal apophyses. The scapula; the sub-spinal portion of the basis.

8. *Angularis vulgo Levator Proprius*. The transverse apophyses of the four first vertebræ of the neck. The scapula; the superior angle and supra-spinal portion of the basis.

9. *Pectoralis Minor*. The second, third, fourth, and fifth true ribs. The scapula; the coracoid apophyses.

10. *Serratus Major*. The scapula; the whole basis. All the true ribs. Sometimes one or two of the false ribs.

11. *Subclavius*. The first rib and its cartilage. The middle and sternal portions of the clavicle.

12. *Deltoides*. The scapula; the spine and acromium. The clavicle. The Os Humeri, under the channel of the biceps.

Muscles which move the Os Humeri on the scapula.

13. *Pectoralis Major*. The clavicle near the sternum. The sternum. All the true ribs. The first false rib, and sometimes the second. The Os Humeri, below the middle of the channel of the biceps.

14. *Latissimus Dorsi*. The six, seven, and sometimes eight lower vertebræ of the back; the spinal apophyses. All the vertebræ of the loins; the spinal apophyses. The Os Sacrum. The Os Ilium. The four lowest false ribs. The scapula; the inferior angle. The Os Humeri, near the upper part of the channel of the biceps.

15. *Teres Major*. The scapula; the inferior angle. The Os Humeri; about the middle of the channel of the biceps.

16. *Teres Minor*. The scapula; the inferior costa. The Os Humeri; the inferior surface of the great tuberosity of the head.

17. *Infra-Spinatus*. The scapula; the sub-spinal cavity or fossa. The Os Humeri; the middle part of the head.

18. *Supra-spinatus*. The scapula; the supra-spinal cavity or fossa. The Os Humeri; the superior part of the head.

19. *Sub-*

19. *Subscapularis*. The inside of the scapula. The Os Humeri; the small tuberosity of the head.

20. *Coraco Brachialis*. The coracoid apophysis of the scapula. The Os Humeri; the middle portion.

21. *Biceps*. The scapula; above the glenoid cavity, and at the coracoid apophysis. The radius; at the tuberosity. *Muscles which move the fore-arm upon the Os Humeri.*

22. *Brachialis*. The Os Humeri; below the insertion of the deltoides. The ulna; below the coronoid apophysis.

23. *Anconaeus Major*. The scapula; at the lower part of neck. The ulna; at the top of the olecranon.

24. *Anconaeus Externus*. The Os Humeri; below the great tuberosity of the head. The ulna; at the olecranon.

25. *Anconaeus Internus*. The Os Humeri; above the middle. The ulna; at the olecranon.

26. *Anconaeus Minor*. The Os Humeri; at the external condyle. The ulna; the external oblong fossula or the head.

27. *Supinator Longus*. The Os Humeri at the crista of the external condyle. The radius; near the styloid apophysis. *Muscles which move the radius on the ulna.*

28. *Supinator Brevis*. The Os Humeri; at the lower part of the external condyle. The radius; the upper quarter of its inside.

29. *Pronator Teres*. The Os Humeri; at the internal condyle. The radius; at the middle convex portion.

30. *Pronator Quadratus*. The ulna; at the long eminence of the lower extremity. The radius; at the broad surface of the lower extremity.

31. *Ulnaris Internus*. The Os Humeri; at the internal condyle. The ulna; at the olecranon, and almost the upper half of the bone. The Os Pisiforme. The Os Unciforme. *Muscles which move the carpus on the fore-arm.*

32. *Radialis Internus*. The Os Humeri; the inner condyle. The first bone of the metacarpus, and sometimes the second. The first phalanx of the thumb.

33. *Ulnaris Externus*. The Os Humeri; at the outer condyle. The fourth and sometimes the third bone of the metacarpus. The first phalanx of the little finger; at the basis.

34. *Radialis Externus Primus & Secundus*. The Os Humeri; at the outer condyle. The first and second bones of the metacarpus.

35. *Ulnaris Gracilis vulgo Palmaris Longus.* The Os Humeri; at the inner condyle. The Os Scaphoides; sometimes immediately, but most commonly by the intervention of the great annular ligament.

36. *Palmaris Cutaneus.* The aponeurosis palmaris; but in no bone.

Muscles which move the metacarpus.

37. *Metatarpius.* The Os Pisiforme. The fourth metacarpal bone.

Muscles which move the fingers.

38. *Flexor Pollicis Longus.* The radius; the inside. The third phalanx of the thumb.

39. *Extensor Pollicis Primus.* The ulna; the outside near the head. The radius; the middle portion of its outside. The first and second phalanges of the thumb.

40. *Extensor Pollicis Secundus.* The ulna; the outside, nearer the middle than the head. The radius; the outside, between the middle and the lower extremity. The third phalanx of the thumb.

41. *Thenar.* The Os Trapezium. The head of the first, and the basis of the second phalanx of the thumb.

42. *Mesothenar.* The first metacarpal bone; the body. The second metacarpal bone, near the head. The head of the first, and the basis of the second phalanx of the thumb.

43. *Antithenar.* The first bone of the metacarpus; near the basis. The first phalanx of the thumb near the head.

44. *Perforatus.* The ulna; near the head, and the inside. The radius in the same manner. The second phalanges of the four fingers; the flat sides.

45. *Perforans.* The ulna; the inside, from the head to the lower third part of the bone. The third phalanges of the four fingers; the flat sides.

46. *Extensor Digitorum.* The Os Humeri; the external condyle. The radius; sometimes a little. The first and third phalanges of the four fingers; the convex sides.

47. *Extensor Indicis Proprius.* The ulna; the inside, between the middle and the lower extremity. The first and third phalanx of the index; the convex side.

48. *Extensor Minimi Digiti Proprius.* The upper half of the ulna; the inside. The phalanges of the little finger; the convex sides.

49. *Lumbricales.* The tendons of the perforatus. The first and third phalanges; the convex sides.

50. *Inter-*

50. *Interossei Externi*. The bones of the metacarpus ; near their convex sides. The first and third phalanges ; the convex sides.

51. *Interossei Interni*. The bones of the metacarpus, the outer and inner sides. The first and third phalanges.

52. *Semi-Interosseus Indicis*. The first phalanx of the thumb ; the outside of the basis. The Os Trapezium. The first phalanx of the index ; near the head.

53. *Hypothenar Minor*. The Os Pisiforme. The first phalanx of the little finger.

54. *Psoas five Lumbaris Internus*. The last vertebra of the back ; the body and transverse apophysis. All the vertebræ of the loins ; in the same manner The Os Femoris ; the little trochanter.

Muscles which move the Os Femoris on the Pelvis.

55. *Iliacus*. The Os Ilium ; the crista, anterior spines, the space between these, and the inside of the bone. The Os Sacrum ; the part of its concave side nearest the Os Ilium. The Os Femoris ; the trochanter minor.

56. *Pectineus*. The Os Pubis ; the crista ; the Os Femoris ; below the little trochanter.

57. *Gluteus Maximus*. The Os Ilium ; the crista and tuberosity. The Os Sacrum ; the lateral part of the convex side. The Os Coccygis ; in the same manner. The Os Femoris ; the long impression below the great trochanter.

58. *Gluteus Minimus*. The Os Ilium ; the outside between the great and small semicircular impressions. The Os Ischium ; the spine. The Os Femoris ; the upper part of the trochanter major.

59. *Triceps Primus*. The Os Pubis ; the tuberosity or spine, and the symphysis. The Os Femoris ; the middle part of the linea aspera.

60. *Triceps Secundus*. The Os Pubis ; the inferior ramus. The Os Femoris ; the upper part of the linea aspera.

61. *Triceps Tertius*. The Os Ischium ; the small ramus, and the tuberosity. The Os Femoris ; the middle part of the linea aspera, and something more, and the tuberosity of the inner condyle.

62. *Pyriformis*. The Os Ilium ; the posterior sinus. The Os Sacrum, the lateral part. The Os Femoris ; the upper part of the great trochanter.

63. *Obturator Internus*. The Os Ilium. The Os Pubis. The Os Ischium; the insides of these three bones, near the foramen ovale, and great sinus. The Os Femoris; near the upper part of the cavity of the great trochanter.

64. *Gemelli*. The Os Ischium; the spine, notch, and tuberosity. The Os Femoris: about the middle of the cavity of the great trochanter.

65. *Obturator Externus*. The Os Pubis; the inside all the way to the foramen ovale. The Os Ischium; the edge of the foramen ovale. The Os Femoris, the middle of the cavity of the great trochanter.

66. *Quadratus*. The Os Ischium; between the acetabulum and the tuberosity. The Os Femoris; the lower half of the oblong eminence of the trochanter major.

67. *Musculus Fascia Latae*. The Os Ilium; the superior anterior spine. The Os Femoris; below the great trochanter.

Muscles which move the leg on the Os Femoris.

68. *Rectus Anterior*. The Os Ilium; the superior anterior spine, and superior part of the supercilium acetabuli. The patella; the upper edge.

69. *Vastus Externus*. The Os Femoris; the posterior rough surface of the great trochanter. The patella; the outer edge. The tibia; the outside of the head.

70. *Vastus Internus*. The Os Femoris; the interior rough surface of the great trochanter. The patella; the inside. The tibia; the inside of the head.

71. *Crureus*. The Os Femoris; along the foreside. The patella; the upper edge.

72. *Sartorius*. The Os Ilium; the superior anterior spine. The tibia; the inner and fore part of the head.

73. *Gracilis Internus*. The Os Pubis; the small ramus near the symphysis. The tibia; the inner and fore part of the head, below the insertion of the sartorius.

74. *Biceps*. The Os Ischium: the posterior and lower part of the tuberosity. The Os Femoris; the lower half of the linea aspera. The head of the fibula.

75. *Semi-nervosus*. The Os Ischium; the upper and posterior part of the tuberosity. The tibia; the inside of the upper extremity, below the insertion of the gracilis internus.

76. *Semi-membranosus*. The Os Ischium; the bony line between

between the acetabulum and the tuberosity. The tibia; the posterior impression of the inner condyle.

77. *Popliteus*. The Os Femoris; the outer edge of the external condyle. The tibia; the oblique line on the backside of the head.

78. *Tibialis Anticus*. The tibia; the upper third part of the crista, and the upper two thirds of the outer flat side. The Os Cuneiforme Majus; the inside. The first bone of the metatarsus; the inside. *Muscles which move the tarsus on the leg.*

79. *Peroneus Medius*. The fibula; the outer or anterior side. The fifth bone of the metatarsus; the tuberosity of the basis.

80. *Peroneus Minimus*. The fibula; the lower half of the inside, between the two oblique lines. The fifth bone of the metatarsus, above and near the basis.

81. *Gastrocnemii*. The Os Femoris; above the condyles, and behind their lateral tuberosities. The Os Calcis; the posterior extremity.

82. *Soleus*. The tibia; the backside from the superior oblique line, to the middle of the bone. The fibula; more than the upper third part of the backside. The Os Calcis; the posterior extremity.

83. *Tibialis Gracilis, vulgo Plantaris*. The Os Femoris; the outer edge of the external condyle. The Os Calcis; the posterior extremity, near the inner edge.

84. *Tibialis Posticus*. The tibia; the upper part of the backside. The fibula; the upper half of the internal angle. The Os Scaphoides; the tuberosity or lower part.

85. *Peroneus Maximus*. The tibia; near its articulation with the fibula on the foreside. The fibula; the outer and foreside of the head and neck, and the upper half of the external angle. The Os Cuneiforme Majus; a little toward the lower part. The first bone of the metatarsus; the lateral impression of the basis.

86. *Extensor Pollicis Longus*. The tibia; near the lower extremity, toward the fibula. The fibula; the upper three fourth parts. The first and second phalanges of the great toe; the bases. *Muscles which move the metatarsus and toes.*

87. *Flexor Pollicis Longus*. The fibula; the lower half of

the backside. The second phalanx of the great toe; the under side.

88. *Thenar*. The Os Calcis; the lower part. The Os Scaphoides; the lower part. The Os Cuneiforme Majus; the lower part. The first phalanx of the great toe; the inside. The internal sesamoide bone.

89. *Antithenar*. The second, third, and fourth bones of the metatarsus; near their bases. The first phalanx of the great toe; the outside. The external sesamoide bone.

90. *Extensor Digitorum Longus*. The tibia; the outside of the head. The fibula; the upper three fourths of the inside. The four small toes; along their upper sides.

91. *Extensor Digitorum Brevis*. The astragalus; the upper side of the anterior apophysis. The first phalanx of the great toe; the upper side. The three following toes, rarely the fifth; the upper sides of all the phalanges.

92. *Flexor Digitorum Brevis*. The Os Calcis; the lower and foreside of the great tuberosity. The second phalanges of the four small toes; the inner part of the under side.

93. *Flexor Digitorum Longus*. The tibia; a little more than the middle third part of the backside. The third phalanges of the four small toes; the under side.

94. *Flexor Digitorum Accessorius*. The Os Calcis; the eminences of the lower side.

95. *Lumbricales*. The first phalanges of the toes, laterally.

96. *Transversalis Pedis*. The last three bones of the metatarsus; the lower sides of the heads, by the intervention of the interosseous ligaments. The first phalanx of the great toe; the outside of the basis.

97. *Interossei Superiores*. The five bones of the metatarsus; near their upper sides. The first phalanx of the second toe; the outer and inner sides. The third and fourth toes; the outsides.

98. *Interossei Inferiores*. Four bones of the metatarsus; toward the under sides. The first phalanges of the last three toes; the insides.

99. *Metarsus*. The Os Calcis; the great inferior tuberosity. The fifth bone of the metatarsus; the under side.

100. *Parathenar Major*. The Os Calcis; the outer part of the lower side. The first phalanx of the little toe; the under side.

101. *Paratbenar Minor*. The fifth bone of the metatarsus; the under part of the outside. The first phalanx of the little toe; the under side of the basis.

102. *Diaphragma*. The sternum; the appendix ensiformis. All the ribs; their bony extremities and cartilages, and almost all the last false rib. The last vertebra of the back; the body. The first three or four vertebræ of the loins; the bodies.

Muscles employed in respiration.

103. *Scaleni*. All the vertebræ of the neck; the transverse apophyses. The first two ribs; the middle and posterior part of the convex side.

104. *Serratus Posticus Superior*. The last two vertebræ of the neck; the spinal apophyses. The first two vertebræ of the back; in the same manner. The second, third, fourth, and sometimes the fifth true ribs; near the angles.

105. *Serratus Posticus Inferior*. The last vertebra of the back; the spinal apophysis. The first three vertebræ of the loins; the spinal apophyses. The last four false ribs.

106. *Intercostales*. All the ribs and their cartilages; the edges.

107. *Supra-Costales*. The last vertebra of the neck; the transverse apophysis. All the vertebræ of the back, except the last; in the same manner. All the ribs; the posterior part of the outside.

108. *Sub-Costales*. The true ribs, from the fourth downward; the concave or insides. The false ribs from the fourth upward; in the same manner.

109. *Sterno-Costales*. The sternum; the edge of the lower half of the inside. The second, third, fourth, fifth, and sixth true ribs; the cartilages near the bony portions.

110. *Sterno-Mastoidæus*. The sternum; the upper edge; near the clavicular notch. The clavicle; near the sternal extremity. The mastoide apophysis; the upper and back part.

Muscles which move the head on the trunk.

111. *Splenius*. The Os Occipitis; the lateral crooked portion of the transverse line. The mastoide apophysis; the upper part. The first three or four vertebræ of the neck; the transverse and spinal apophyses. The first three or more vertebræ of the back; the spinal apophyses.

112. *Complexus Major*. The first vertebra of the neck; backward near the transverse apophysis. The six following vertebræ;

vertebræ; the transverse apophyses. The Os Occipitis; the posterior portion of the superior transverse line.

113. *Complexus Minor*. The six lower vertebræ of the neck; the transverse apophyses. The mastoide apophysis; posteriorly.

114. *Rectus Major*. The second vertebra of the neck; the spinal apophysis. The Os Occipitis; the posterior part of the inferior transverse line.

115. *Rectus Minor*. The first vertebra of the neck; the posterior tubercle. The Os Occipitis; below the posterior part of the lower transverse line, in a fossula near the crista.

116. *Obliquus Superior*. The first vertebra of the neck; the extremity of the transverse apophysis. The Os Occipitis; the middle portion of the inferior transverse line.

117. *Obliquus Inferior*. The first vertebra of the neck; the transverse apophysis. The second vertebra; the spinal apophysis.

118. *Rectus Anticus Longus*. The third, fourth, fifth, and sixth vertebræ of the neck; the forepart of the transverse apophyses. The Os Occipitis; the lower and anterior part of the apophysis basilaris.

119. *Rectus Anticus Brevis*. The first vertebra of the neck on one side of the anterior middle eminence. The Os Occipitis; the apophysis basilaris; a little more forward than the condyle.

120. *Transversalis Anticus Primus*. The first vertebra of the neck; the foreside of the transverse apophysis. The basis of the occipital bone; below the edge of the jugular fossula.

121. *Transversalis Anticus Secundus*. The second vertebra of the neck; the middle of the transverse apophysis, anteriorly. The first vertebra; the basis of the transverse apophysis, anteriorly.

122. *Musculi Accessorii*. The basis of the Os Occipitis. The first two vertebræ of the neck.

The several classes of the vertebral muscles are these. (1.)

*Vertebral muscles
in general.*

Spinales simplices. (2.) Spinales compositi. (3.) Transversales simplices. (4.) Transversales compositi. (5.) Spino-transversales. (6.) Tranverso-spinales. (7.) Obliqui, which go from one transverse,

transverse, to several spinal apophyses. (8.) Obliqui, which go from several transverse, to one spinal apophysis.

123. *Longus Colli*. The first vertebra of the neck; the middle tubercle. The three following vertebræ; the bodies anteriorly. The second *Vertebral muscles in particular.* third, fourth, fifth, and sixth vertebræ of the neck; the bodies near the transverse apophyses, and these apophyses anteriorly. The last vertebra of the neck; the anterior lateral part of the body. The first three, and sometimes the fourth vertebra of the back, in the same manner.

124. *Transversalis Colli Major*. All the vertebræ of the neck; the transverse apophyses. The first four, five, or six vertebræ of the back, in the same manner.

125. *Transversalis Colli Minor*. On one side of the transversalis major.

126. *Semi-Spinalis*. All the vertebræ of the neck, except the first. The six upper vertebræ of the back, or more.

127. *Spinales Colli Minores*. All the vertebræ of the neck, except the first; the spinal apophyses. The first vertebra of the back; in the same manner.

128. *Transversales Colli Minores*. The vertebræ of the neck; the transverse apophyses. The first vertebra of the back; the spinal apophysis.

129. *Sacro-Lumbaris*. The vertebræ of the neck; the transverse apophyses. The ribs; the angular marks. The Os Sacrum; the superior spines, and contiguous lateral parts. The Os Ilium; the posterior portion of the crista and the tuberosity.

130. *Longissimus Dorsi*. The last vertebra of the neck; the transverse apophysis. The first seven vertebræ of the back; the transverse apophyses. The last vertebra of the back; the spinal apophysis. All the vertebræ of the loins; the spinal apophyses. The Os Sacrum; the superior spines, and upper lateral part. All the true ribs; the tuberosities. All the false ribs; between the tuberosities and the angular marks.

131. *Spinalis Dorsi Major*. All the vertebræ of the back, except the first, and sometimes the second; the spinal apophyses. The first and sometimes the second vertebra of the loins; the spinal apophyses.

132. *Spi-*

132. *Spinales Dorſi Minores*. All the vertebræ of the back; the ſpinal apophyſes. The firſt vertebra of the loins; in the ſame manner.

133. *Transverſalis Dorſi Major*. Vide Longiſſimus dorſi.

134. *Transverſales Dorſi Minores*. The vertebræ of the back; the tranſverſe apophyſes.

135. *Semi-Spinalis Dorſi*. The vertebræ of the back; the twelve ſpinal, and ten loweſt tranſverſe apophyſes. The firſt three vertebræ of the loins; the tranſverſe apophyſes.

136. *Semi ſpinalis Lumborum*. The three loweſt vertebræ of the loins; the tranſverſe and articular apophyſes. The Os Sacrum; the ſuperior lateral parts. The Os Ilium; the ſuperior poſterior ſpine.

137. *Quadratus Lumborum*. The laſt false rib. The vertebræ of the loins, the tranſverſe apophyſes. The Os Sacrum; the upper lateral part. The Os Ilium; almoſt the poſterior half of the criſta.

138. *Spinales et Transverſales Lumborum*. The Os Sacrum; the ſuperior ſpines. The vertebræ of the loins; the ſpinal and tranſverſe apophyſes.

139. *Coccygæus Anterior*. The Os Ilium; the inſide. The Os Iſchium; the inſide of the body of the bone, behind the foramen ovale. The Os Coccygis; the lateral and lower part of the inſide.

140. *Coccygæus Poſterior*. The Os Sacrum; the foreſide of the firſt two vertebræ. The Os Iſchium; the inſide of the ſpine. The Os Coccygis; the lateral middle part of the inſide.

141. *Pſoas Parvus*. The laſt vertebra of the back, or firſt of the loins, or both; the tranſverſe apophyſes. The Os Pubis; the criſta.

142. *Maſſeter*. The Os Temporum; the zygomatic apophyſis. The Os Maxillare; near the Os Malæ. The Os Malæ; the lower edge; the lower jaw; at the angle, above the angle, and at the root of the coronoide apophyſis; all on the outſide.

143. *Temporalis*. The Os Frontis; the outſide, behind the angular apophyſis. The Os Parietale; the outſide, between the ſemicircular impreſſion, and the ſquammoſ ſlope. The Os Temporum; the outſide of the ſquammoſ portion.

The

*Muſcles which move
the lower jaw.*

The Os Sphenoidale ; the outside of the great temporal ala. The Os Malæ ; the zygomatic fossa. The maxilla inferior ; the coronoide apophysis.

144. *Pterygoideus Internus*. The Os Sphenoides ; the Pterygoide apophysis, at the inside of the external ala. The maxilla inferior ; the inside near the angle.

145. *Pterygoideus Externus*. The Os Sphenoidale ; the apophysis pterygoides, at the outside of the external ala. The maxilla inferior ; the fossula of the condyloide apophysis.

146. *Digastricus*. The Os Temporum ; the mastoide sulcus. The lower jaw, the inner labium of the basis of the chin. The Os Hyoides ; the lateral part.

147. *Mylo Hyoidæus*. The maxilla inferior ; the inside, above the oblique prominent line. The Os Hyoides ; the basis, anteriorly.

Muscles which move the Os Hyoides.

148. *Genio Hyoidæus*. The maxilla inferior ; the inside of the chin, at the inferior rough impression, near the symphysis. The Os Hyoides ; the upper part of the basis anteriorly, and the root of the cornu.

149. *Stylo-Hyoidæus*. The Os Temporum ; the basis of the apophysis styloides. The Os Hyoides ; the lateral part of the basis, and the symphysis of the cornu.

150. *Omo-Hyoidæus*. The scapula ; the superior costa, and sometimes the coracoide apophysis. The Os Hyoides ; the lateral inferior part of the basis, near the cornu.

151. *Sterno-Hyoidæus*. The sternum ; the upper part toward the inside, near the notch. The clavicula sometimes ; the sternal extremity. The Os Hyoides ; the lower edge of the basis.

A R T. XX.

An enumeration of the bones mentioned in the description of the muscles; and of the muscles inserted in each bone.

1. *Os Frontis.* **T**emporalis.

2. *Os Parietale.* Temporalis.

3. *Os Temporum.* Temporalis. Masseter. Digastricus. Stylo-hyoidæus. Sterno-mastoidæus. Splenius. Complexus minor.

4. *Os Sphenoidale.* Temporalis. Pterygoidæus externus. Pterygoidæus internus.

5. *Os Occipitis.* Splenius. Complexus major. Complexus minor. Rectus major posticus. Rectus minor posticus. Obliquus minor. Sterno-mastoidæus. Rectus anticus longus. Rectus anticus brevis. Transversalis anticus primus. Trapezium scapulæ.

6. *Os Mala.* Temporalis. Masseter.

7. *Maxilla Inferior.* Masseter. Temporalis. Pterygoidæus internus. Pterygoidæus externus. Digastricus. Genio-hyoidæus. Mylo-hyoidæus.

8. *Os Hyoides.* Stylo-Hyoidæus. Genio-hyoidæus. Mylo-hyoidæus. Omo-hyoidæus. Sterno-hyoidæus.

9. *Vertebra Colli.* Splenius. Complexus Major. Complexus minor. Rectus major posticus. Rectus minor posticus. Obliquus superior. Obliquus inferior. Rectus anticus longus. Rectus anticus brevis. Transversalis anticus primus. Transversalis anticus secundus. Longus colli. Transversalis major colli. Transversalis gracilis colli. Semi-spinalis colli. Spinales colli minores. Transversales colli minores. Scalenii. Trapezium scapulæ. Rhomboides. Angularis. Longissimus dorsi. Serratus superior posticus. Sacro-lumbaris. Supracostales.

10. *Vertebra Dorsi.* Trapezium. Latissimus dorsi. Rhomboides. Serratus superior posticus. Splenius. Complexus major. Complexus minor. Longus colli. Transversalis colli major. Transversalis colli gracilis. Semi-spinales colli. Transversalium colli minorum unus. Sacro-lumbaris. Longissimus

gissimus dorsi. Longissimi dorsi accessorius. Spinalis dorsi major. Transversalis dorsi major. Transversales dorsi minores. Supra-costales. Semi-spinalis dorsi. Diaphragma. Serratus posticus inferior. Psoas major. Psoas parvus. Psoas parvus accessorius.

11. *Vertebræ Lumborum.* Transversalis abdominis. Latissimus dorsi. Quadratus lumborum. Lumbaris externus minor. Diaphragma. Semi-spinalis lumborum. Spinales lumborum. Psoas Parvus. Serratus inferior posticus,

12. *Os Sacrum.* Latissimus dorsi, Sacro Lumbaris. Longissimus dorsi. Semi-spinalis lumborum. Spinalium & transversalium lumborum unus. Sacro-coccygæus. Glutæus maximus.

13. *Os Coccygis.* Sacro coccygæus. Ischio-coccygæus. Glutæus maximus.

14. *Sternum.* Sterno-mastoidæus. Sterno-hyoidæus. Subclavius. Pectoralis major. Sterno-costales. Diaphragma. Transversalis abdominis. Rectus abdominis.

15. *Costæ.* Supra-costales. Inter-costales. Sub-costales. Sterno-costales. Scalenii. Serratus posticus superior. Serratus posticus inferior. Sacro-lumbaris. Longissimus dorsi. Diaphragma. Quadratus lumborum. Subclavius. Pectoralis minor. Pectoralis major. Serratus major. Latissimus dorsi. Obliquus externus abdominis. Obliquus internus abdominis. Transversalis abdominis. Rectus abdominis.

16. *Os Ilium.* Obliquus externus abdominis. Obliquus internus abdominis. Transversalis abdominis. Latissimus dorsi. Sacro-lumbaris. Longissimus dorsi. Quadratus lumborum. Iliacus Glutæus maximus. Glutæus medius. Glutæus minimus. Pyriformis. Obturator internus. Musculus fasciæ latæ. Sartorius. Rectus Gracilis.

17. *Os Pubis.* Obliquus abdominis externus. Obliquus internus abdominis. Transversalis abdominis (*sometimes.*) Rectus abdominis. Pyramidalis abdominis. Psoas parvus. Pectineus. Obturator externus. Obturator internus. Rectus sive gracilis internus. Triceps primus. Triceps secundus.

18. *Os Ischium.* Coccygæus anterior. Obturator internus Gemelli. Obturator externus. Quadratus femoris. Triceps secundus (*sometimes*). Tricipes tertius. Biceps tibiæ. Semi-nervosus. Semi-membranosus.

19. *Scapula*. Omo-hyoidæus. Trapezius. Rhomboides. Angularis. Pectoralis minor. Serratus major. Supra-spinatus. Infra-spinatus. Teres major. Teres minor. Subscapularis. Latissimus dorsi. Biceps. Anconæus maximus. Deltoides.

20. *Clavicula*. Sterno-mastoidæus. Sterno hyoidæus. Trapezius. Subclavius. Deltoides. Pectoralis major.

21. *Os Humeri*. Deltoides. Pectoralis major. Latissimus dorsi. Teres major. Supra-spinatus. Infra-spinatus. Biceps. Brachialis. Anconæus externus. Anconæus internus. Anconæus minimus. Ulnaris internus. Radialis internus. Ulnaris gracilis. Ulnaris externus. Radialis externus. Supinator longus. Supinator brevis. Pronator teres. Extensor digitorum communis.

22. *Ulna*. Brachialis. Anconæus major. Anconæus externus. Anconæus internus. Anconæus minor. Pronator quadratus. Ulnaris internus. Ulnaris externus. Extensor pollicis. Perforatus. Perforans. Extensor indicis proprius. Extensor minimi digiti proprius.

23. *Radius*. Biceps. Supinator longus. Supinator brevis. Pronator teres. Pronator quadratus. Ulnaris externus (*in the annular ligament at the head of the radius*). Flexor pollicis longus. Perforatus. Extensor digitorum communis.

24. *Os Pisiforme & Unciforme*. Ulnaris internus.

25. *Os Scaphoides*. Ulnaris gracilis sive palmaris longus.

26. *Os Naviculare Magnum & Trapezoides*. Interossei.

27. *Bones of the Metacarpus*. Interossei. Radialis externi. Mesothenar. Metacarpus. Hypothenar minor.

28. *First phalanx of the thumb*. Extensor pollicis primus. Thenar. Mesothenar. Antithenar.

29. *Second phalanx of the thumb*. Extensor pollicis primus & secundus. Thenar, Mesothenar.

30. *Third phalanx of the thumb*. Flexor pollicis longus.

31. *First phalanges of the fingers*. Extensor digitorum communis. Interossei.

32. *Second phalanges of the fingers*. Perforatus.

33. *Third phalanges of the fingers*. Extensor digitorum communis. Perforans.

34. *Index*. Extensor indicis proprius.

35. *Little finger*. Extensor minimi digiti proprius.

36. *Os*

36. *Os Femoris.* Psoas. Iliacus. Pectineus. Gluteus maximus, medius, & minimus. Musculus fasciæ latæ. Triiceps primus, secundus, & tertius. Vastus externus. Vastus internus. Crureus. Biceps. Popliteus. Gastrocnemii. Tibialis gracilis.

37. *Patella.* Vastus Externus. Vastus internus. Crureus. Rectus anterior.

38. *Tibia* Vastus externus. Vastus internus. Rectus anterior. Semi-membranosus. Semi-nervosus. Gracilis internus. Sartorius. Popliteus. Tibialis anticus. Extensor pollicis longus. Extensor digitorum longus. Soleus. Tibialis posticus. Peronæus longus. Flexor digitorum longus.

39. *Fibula.* Biceps. Peronæus medius. Peronæus minimus. Soleus. Peronæus longus. Extensor pollicis longus. Flexor pollicis longus. Extensor digitorum longus.

40. *Astragalus.* Extensor digitorum brevis.

41. *Os Calcis.* Gastrocnemii. Soleus. Tibialis gracilis. Tibialis posticus. Thenar. Perforatus sive flexor digitorum brevis. Flexor digitorum accessorius. Metatarsius. Parathenar major.

42. *Os Scaphoides.* Tibialis posticus thenar.

43. *Os Cuneiforme Majus.* Tibialis anticus. Peronæus maximus. Thenar.

44. *Bones of the metatarsus.* Tibialis anticus. Peronæus maximus. Antithenar. Transversalis pedis. Interossei. Peronæus medius. Peronæus minimus. Metatarsius. Parathenar minor.

45. *Bones of the great toe.* Extensor pollicis longus. Extensor pollicis brevis. Transversalis pedis. Thenar. Antithenar. Flexor pollicis longus.

46. *Bones of the small toes.* Flexor digitorum longus. Interossei. Flexor digitorum brevis. Parathenar major. Extensor digitorum longus. Extensor digitorum brevis.

A R T. XXI.

The particular uses of the muscles which are wholly inserted in bones.

777. **I** Observed in the beginning of this section, N^o 34. that the use of each muscle in particular, is confined to the motion of one or more moveable parts; and that some parts require a certain number of muscles to move them, whereof some act one way and some another. Several muscles, for instance, move the Os Humeri upon the scapula, and of these some raise, others depress it; some turn it forward, some backward, and others round its axis, &c.

778. I took notice, N^o 37, of the inconveniencies of the common language of anatomists, with respect to the names of many muscles; with respect to the uses attributed to them, they being limited to these, as if they could not have any other; and with respect to the bones, the changes of situation of which are confined to the action of a certain number of muscles, as if no other muscles were capable of producing them.

779. I remarked, N^o 38. 39. that in order to shun these inconveniencies, it would be proper to distribute and enumerate the muscles in another manner than is commonly done. Thus, for instance, instead of this title: *The muscles of the arm*, I would put the following: *The muscles which move the Os Humeri on the scapula, and the scapula on the Os Humeri*. But lest such titles might be reckoned too long, I have omitted the reciprocal motions, mentioning them only in the description of each muscle; and there I have likewise pointed out the other muscles which may have the same uses with those I treat of; and also the other uses which these muscles may have. The muscles which may move certain bones without being inserted in them, I term *assistant* or *auxiliary* muscles.

780. Before we enter upon the detail of these particular uses, it is likewise proper to call to mind what I said N^o 41. 42. 43. concerning the congeneres and antagonist muscles; concerning simple and direct motions; and those that are combined

combined or compounded ; concerning tonic motions ; concerning the co-operation of muscles ; and concerning the distinction of principal movers, moderators, and directors.

781. It will not be amiss to repeat here what I said N^o 56. and 58. that in order to comprehend all the uses and contrivances of each muscle in particular, we ought to examine its place or situation in general, its external conformation, structure, or composition, particular situation, direction, lateral connections ; how it is disposed with respect to the neighbouring muscles, for the production of simple motions ; and with respect to the muscles at a greater distance, for the production of compound motions ; and lastly, with respect to the bones, as a moving power, applied to the different kinds of levers.

782. These inquiries very necessary for philosophical reasonings, physical prescriptions, and chirurgical operations, will be very much facilitated by the help of the two foregoing tables ; in the first of which we see at one view, in what bones, in how many bones, and in what parts of bones, each muscle is inserted ; and in the second, to what muscles, and to what number of muscles, each bone gives insertions.

783. But to make a due use of these two tables, we ought to be previously acquainted with the articulations of bones, especially those of fresh subjects, and from thence be able exactly to determine in how many different directions each bone is capable of being moved. We ought likewise to know not only the general direction of each muscle, but also all the possible situations or different attitudes of the bones in which each muscle is inserted.

784. The experiments made on dead bodies, by pulling the muscles after they have been raised, are very fallacious ; especially in the long muscles parted from all their lateral connections ; and still more when the natural direction of these muscles is oblique, or when they are naturally designed for oblique motions ; not to mention how much, by this way of management, a dissected muscle may be increased in length. We have instances of such mistakes in the sternomastoidæus, supinator longus, sartorius, peronæus longus, &c. as we shall see hereafter.

785. The terms of raising, depressing, bringing forward, backward, &c. used here, are to be considered as applied to the

the subject, in an erect posture; and I understand by them not only the effects of a real motion, or a real change of situation; but also the force employed to keep any part in the same situation against a resistance or contrary force.

786. Thus when I say that the biceps bends the fore-arm, I mean likewise that its action tends to preserve that part in any given situation against a contrary force applied to extend it; and we see from experience, that in these kinds of efforts, without any real motion, in proportion as the resistance increases, the muscle grows stiffer or harder, without producing any change of place.

§ 1. *Uses of the muscles which move the bones of the shoulder on the trunk.*

787. The mechanism of the scapula in relation to its motions and changes of situation, is very different from that of all the other bones of the body, except the Os Hyoides, of which I shall speak hereafter. All the other bones have solid fulcra or fixed points, on which they are either moved or fixed by the muscles; but the motions of the scapula, its changes of situation, and its continuance in any one given attitude, are brought about without the help of any solid fulcrum. The muscles alone sustain it and brace it down, in all its different motions and situations.

788. The scapula has this peculiarity likewise belonging to it, that it is the fulcrum and basis of all the motions of the Os Humeri, of some motions of the fore-arm; and even of all the most violent efforts made with these bones; without being itself either moved or fixed on any solid basis.

789. We ought not here to have any regard to the clavicle, which seems to be only a kind of os accessorium in men, and such other animals as can turn their fore-feet forward, to lay hold of any thing, almost in the same manner as we turn the hand in supination and pronation. In all other animals, no claviculæ are to be found; and therefore the scapula is the principal, or rather, the only piece of which the shoulder is formed.

790. The motions and different situations of the shoulder in men depend chiefly on the scapula. The clavicle is pushed or pulled in different directions by the other bone, and
entirely

entirely follows its motions, serving in some circumstances to regulate or limit them.

791. It is necessary to examine with attention all the motions of which the scapula can be capable. It is not enough to say that it may be raised, brought down, forward, backward, &c. which language, as commonly understood, has given rise to several false ideas concerning the action of the muscles to which the motions of this bone are attributed.

792. When we raise the shoulder, this motion is not ordinarily made by an uniform elevation of the scapula, or, as it were, in a direction parallel to itself. It is the acromium which rises, and while the superior angle descends, the inferior angle is removed to a greater distance from the spina dorsii. When the shoulder is depressed, the acromium falls down more or less, the superior angle rises in proportion, and the inferior angle is brought nearer the vertebræ.

793. The shoulder can scarcely be brought forward or toward the foreside of the thorax, without being proportionably raised; and there is the same difficulty in drawing it back without depressing it more or less. Every one may soon satisfy himself as to the truth of these facts. All these different attitudes are regulated by the clavícula, the angle which it naturally makes with the scapula, being lessened or made more acute in raising the shoulder, or in bringing it forward; and increased or made more obtuse when the shoulder is depressed, or drawn backward.

794. Therefore in most of the motions or changes of situation performed by the scapula, this bone turns more or less upon its own plane, and that in two contrary directions. It cannot indeed be absolutely denied but that the scapula may be brought directly forward or backward, without being raised or depressed; but these are very constrained and very inconsiderable motions. In the first case, the acromium, together with the humeral extremity of the clavícula, is removed to a greater distance from the ribs, and in the second, it is brought nearer to the ribs.

795. We ought to consider, with particular attention, the situation and motion of the shoulder when we raise it to support a burden, or apply it to any other resistance. It is the acromium alone which is exposed, and loaded, and with which we endeavour to overcome the resistance or support the burden

den without sinking under it. There must be muscles proper for making all these efforts, and capable of producing all the different motions.

796. The three different portions of the trapezius, may all have the same use, according to what I have *Trapezius.* observed concerning the different turns of the scapula in its motions. This use is to raise the shoulder, and to keep it from sinking. The upper portion draws the acromium and extremity of the clavicle upward. The inferior portion draws downward the small extremity of the spine of the scapula. By these two contrary motions, the situation of the spine is changed; and as the acromium, by reason of its articulations with the clavicle, cannot move backward while it rises, the small extremity of the spine must be removed to a greater distance from the vertebræ while it descends.

797. The middle portion, by its superior and longest fibres concurs with the action of the upper portion, more or less, according to the extent and direction of these fibres. The other fibres, which become gradually shorter and more transverse, partly join in the same action by reason of the obliquity of the spine in which they are inserted, and partly serve to regulate and limit the removal of the spine from the vertebræ already mentioned.

798. The upper fibres of this middle portion may likewise in some circumstances supply the place of the superior portion; as when we would raise the shoulder, the head being inclined to the same side; for then the fibres of the superior portion which are inserted in the Os Occipitis, have not room enough to contract. The obliquity of the upper fibres of the middle portion, and of the spine of the scapula, in which they are inserted, facilitates their action in this case.

799. The use of the trapezius therefore, regard being had to the direction and insertion of its fibres, is to raise the shoulder, or rather to turn the top of the scapula upward, and to hinder it from sinking. But it is too thin, and consists of too few fibres, to be able to overcome or bear up against some resistances, without the co-operation of the serratus major, as we shall see presently.

800. From this account of the use of the trapezius, we see how improper it is to say, with the generality of anatomists,

romists, that the superior portion of this muscle draws the scapula obliquely upward; the inferior portion obliquely downward; and all the three portions directly backward. This way of speaking is not only improper, but likewise leads us to imagine that by the action of the trapezius all the parts of the scapula are raised, depressed, or carried backward.

801. The serratus major raises the shoulder or top of the scapula, brings it forward, and hinders it from sinking. In all these it is the principal actor; and it is impossible to conceive how labourers raise and support, by the shoulder alone, the heavy burdens with which they are loaded, without the assistance of this muscle.

Serratus major.

802. The thickness, length, and particular disposition of its fibres, but above all, the insertion of the greatest portion of them, near the angle of the basis scapulæ, prove sufficiently what I advance; and the general action of the radiated portions is to draw the inferior angle from the spina dorsi, toward the lateral parts of the thorax.

803. The uppermost and strongest portions pull this angle upwards at the same time; and consequently raise the acromium, which cannot be pushed forward, by reason of its connection with the clavícula.

804. These superior portions cross over the greatest part of the true ribs, and accordingly, in raising great burdens, we find ourselves obliged to hold in our breath, that is, to lessen expiration as much as we can, in order to fix the ribs, and to hinder them from sinking, that they may serve for a solid fulcrum to this muscle in proportion to the force with which it acts.

805. The next portions run according to the length of the ribs, and consequently do not much constrain them in their reciprocal motions, not being in a condition either to raise or depress them; and the most inferior and weakest portions are only assistants to the rest in bringing the lower angle of the scapula forward, toward the lateral part of the thorax.

806. The small distinct plane described N^o 164. is not an assistant to the radiated portions or inferior part of the great plane. It seems designed to regulate the motion of the superior angle backward and downward, while the inferior is carried forward and upward by the radiated portions; and when

their action ceases, to bring the scapula back to its natural place.

807. The superior portion of the great plane is an assistant partly to the radiated portion, and partly to the small plane, according to the different places of its insertions in the basis of the scapula.

808. From all this we see that the principal use of the serratus major is to raise the shoulder, and not for respiration. When both planes act together, this muscle may in some cases bring the shoulder directly forward, or rather hinder it from going back; as when we push any thing with great force directly forward, with the hand, especially when the arm is extended.

809. A whole treatise might be written on the numerous phenomena observable in the motion of the shoulder by the action of this muscle; as I have shewn in the memoirs of the royal academy of sciences. Some of these shall be mentioned in describing the uses of the other muscles that move the shoulder; and when I come to those which are employed in respiration, I shall explain more at length, why this muscle can have no part therein.

Rhomboides. 810. According to the insertions and direction of the rhomboides, its general use must be to draw backward and upward the sub-spinal portion of the basis scapulæ.

811. It is likewise a moderator to the trapezius and serratus major, when they raise the shoulder or carry the acromium upward; and it brings the scapula back to its natural situation, when the action of these muscles ceases.

812. It may draw the scapula directly backward, if the inferior portion of the trapezius acts at the same time. For as this portion draws obliquely downward and toward the spina dorsi, and the rhomboides obliquely upward and toward the same spine; the joint action of both must produce a motion directly backward, as it happens when we pull back both shoulders equally, in order to disengage them.

813. It may likewise, together with the radiated portion of the serratus major, draw the basis of the scapula directly backward. This however is but an inconsiderable motion, and not so easy as the rest; for the serratus major contributes to it only in proportion to the action of the rhomboides, which

which is but very small, and in this case the acromium can rise but a very little way.

814. The angularis, by its insertion in the superior angle of the scapula, moderates the descent of that angle, while the trapezius and serratus major raise the acromium. Afterwards when these two muscles cease to act, the angularis raises the superior angle, and by that means depresses the acromium, much in the same manner as was observed of the rhomboides. *Angularis.*

815. From hence we see that this muscle is very improperly called *levator scapulæ proprius*, since it does not raise, but depresses the scapula. That name would agree better to the serratus major. Whether this muscle can have any share in moving the neck, the scapula in which it is inserted being kept immoveable by other muscles, I cannot at present determine.

816. The pectoralis minor assists the rhomboides and angularis as moderators of the action of the trapezius and serratus major, in turning the point of the acromium upward, the superior angle downward, and the inferior angle forward. *Pectoralis minor.*

817. It is likewise an assistant to the rhomboides and angularis, in restoring the scapula to its natural situation, when the trapezius and serratus major cease to act, by drawing downward the apophysis coracoides in which it is inserted.

818. It has been reckoned among the muscles employed in respiration, by some who imagine that in some cases the shoulder may be kept so steady, as that this muscle may be able to raise the ribs in which it is fixed. But as the serratus major, which must principally be employed in keeping the shoulder in a fixed position, is partly inserted in the same ribs, and in this action must keep them depressed, it will be impossible for the pectoralis minor to raise them.

819. The subclavius can have no other ordinary use, but to bring down the clavicle, after it has been raised together with the acromium by the action of the trapezius and serratus major. It may likewise hinder not only the clavicle in which it is inserted, but likewise the acromium from rising, especially when assisted by the pectoralis minor, rhomboides, and angularis. *Subclavius.*

820. When we stand or sit, the weight of the arm alone seems

seems to be sufficient to bring down the clavicle when raised; and therefore, in this case, there would be no occasion for the subclavius to act upon the clavicle, nor for the pectoralis minor, rhomboides, and angularis to act upon the acromium. But when we lie or are situated in any other manner, the weight of the arm has no such effect; and in these cases these four muscles become more or less necessary.

821. The subclavius therefore is a proper depressor of the clavicle; and an assistant depressor of the acromium, or of the shoulder in general, together with the pectoralis minor, rhomboides, and angularis, all which, in their turns, assist the subclavius in its action on the clavicle.

822. I cannot conceive what has led several great anatomists to rank this among the muscles of respiration; since it is inserted, not only in the bone, but in the cartilage of the first rib; since this cartilage is not articulated with the sternum, but joined to it as immoveably as to the bone of the rib by its other extremity; and lastly, since this cartilage is much shorter, much broader, and much less pliable than the cartilages of all the other ribs, of equal thickness.

§ 2. *Uses of the muscles which move the Os Humeri on the scapula.*

823. This muscle, from the disposition of its insertions in the scapula and clavicle, may raise the arm, or separate it from the ribs, not only directly, but likewise obliquely in many different ways. The arm being lifted directly upward, the lateral, anterior, and posterior portions of this muscle, may bring the arm so raised, forward and backward. In that case, the middle portion of the muscle is the principal mover, and the lateral portions are the directors or collateral muscles.

824. When we stand or sit, this muscle alone, without the help of any other, regulates the depression of the arm, by means only of the weight of the part. This depression is brought about merely by the relaxation of this muscle, proportionable to the degree of velocity it has required according as the will directs.

825. But when we lie, other muscles are necessary to bring the arm near the ribs, when the deltoïdes has carried it to
any

any distance from them. Yet even in this case, when the arm is laid close to the ribs, the lateral portions of the deltoides may press it harder against them, by reason of the change of direction of the fibres in this situation.

826. By reason of the multiplicity of fleshy fibres, this muscle must act with a very considerable force.

827. The latissimus dorsi serves in general to bring down the arm when raised; and this it does chiefly by its inferior portion. By the same portion, and by the *Latissimus Dorsi*, connection of the scapula with the Os Humeri, it serves to depress the shoulder, or to maintain it in that situation against any force that endeavours to raise it; as when we lean upon the elbow in sitting, or walk upon crutches.

828. By its dorsal insertion, by the passage of its tendon on the inside of the Os Humeri, and by its insertion in the fore-side of that bone, it may turn the arm round its axis, called *rotation* by anatomists; as it happens when having bent the fore-arm, we turn it behind our back.

829. By its insertion in the crista of the Os Ilium, and in the false ribs, it becomes necessary to raise the head laterally to one side, when we lie on the other. For the shoulder being then depressed and brought near the thorax, the clavicle becomes the fixed point of one or two of the muscles which raise the head in this situation, as shall be shewn more at length in speaking of the uses of these muscles. Any person may make the experiment in bed, by lying at full length on his side: for if, while he raises his head in this posture, he lay his hand on the anterior edge of this muscle, he will find it considerably stretched, and also, that this tension ceases whenever he ceases to lift his head.

830. The connection of this muscle with the false ribs, is the cause of that uneasiness which we find in breathing, when the arm is pulled strongly downward to press upon any thing, as when we seal a letter, or lean upon a short cane, the fore-arm being extended.

831. The small portion inserted in the inferior angle of the scapula, may be an assistant to the teres major, as shall be shewn hereafter.

832. This muscle sustains the weight of the whole body, when with the arms raised, we hang by the hands, as when we grasp the branch of a tree in climbing.

833. It

833. It performs the same office, when we either sit or stand, with the whole arm more or less extended horizontally, and press the hand from above downward against any resistance; as when we support ourselves in this situation, by a very long cane grasped by the hand; or lay hold of the upper part of an halbard, and press the lower end strongly against the ground

834. These last three uses cannot however be well executed by this muscle alone, without the assistance of the pectoralis major.

835. The pectoralis major serves in general, to bring the arm near the ribs, to press it strongly against them, and to carry it towards the forepart of the thorax. This last motion may be performed without separating the arm from the ribs, as when one arm is crossed over the other; and it may likewise be done with the arm raised, as when the hand of one side is laid over the shoulder of the other side; and in that case the anterior portion of the deltoides may assist this muscle in great efforts.

836. By means of the fold in its tendon, the superior and inferior portions may act as two distinct muscles, that is, one may act without the other. The superior fleshy portion which answers to the lower portion of the tendon, serves chiefly to raise the arm forward.

837. The inferior fleshy portion which is joined to the upper portion of the tendon, by its insertion in the Os Humeri, and by the connection of that bone with the scapula, may depress the shoulder or keep it from rising, with more or less force, much after the same manner as the inferior portion of the latissimus dorsi; the inferior portions of these two muscles concurring in the same use; as when we support ourselves upon our hands or walk with crutches, as has been already said.

838. It is likewise by means of the lower portion of this muscle, that we can suspend the whole body by the hands grasping the branch of a tree in climbing, &c. In this case also, the latissimus dorsi acts in concert with the pectoralis; and this co-operation, the painters and carvers have taken care to express in crucifixes.

839. The inferior portion of this muscle cannot perform these two uses without the assistance of the muscles of the abdomen,

abdomen, which, by pulling the ribs downward, become in a manner a continuation of the insertion of this portion. The same thing may be observed concerning that part of the inferior portion of the latissimus dorsi, which is inserted in the false ribs.

840. The uses of the superior portion and of all the body of the pectoralis, cannot take place without the co-operation of the muscles which move the scapula on the trunk, especially the serratus major; because the scapula must be securely fixed, before it can be a fulcrum for the Os Humeri to move upon. The same thing is to be observed concerning the deltoides, and all the other muscles which move the Os Humeri on the scapula.

841. The teres major, by being inserted in the Os Humeri in a direction parallel to the latissimus dorsi, becomes a congener to the superior and posterior portion of that muscle; and accordingly moves the Os Humeri in the same manner with it. It turns the bone round its axis, when the fore-arm is carried behind the back. *Teres Major.*

842. It likewise pulls the arm directly backward without moving it round its axis. But neither this muscle nor the latissimus dorsi can perform this simple motion, because of the incurvated direction of their tendons, without the assistance of other muscles, which, like antagonists, prevent the rotation already mentioned; and of this number is the teres minor, as we shall see presently.

843. The nearness of the tendon of this muscle to that of the latissimus dorsi deserves our attention. They are both inserted, according to their breadth, in the same line, along the edge of the bony channel of the Os Humeri, opposite to the insertion of the pectoralis major in the other edge of the same channel. These two tendons cross each other in the same plane, that of the teres major running obliquely from above downward, and that of the latissimus dorsi, obliquely from below upward.

844. By this disposition, these two tendons resemble, in a great measure, the duplicature or fold of the tendon of the pectoralis major; and therefore the teres major may become a particular antagonist to the superior portion of the pectoralis major; and the latissimus dorsi to the inferior portion;

and both muscles taken together may be a common antagonist to the pectoralis major, when that whole muscle acts at the same time.

845. I observed, N^o 198. 204. that these two tendons were bound down by a ligamentary frænum, which from the insertion of the subscapularis runs down below that of the teres major; and that this frænum covers the two tendons, and braces them down close to the bone. The use of this frænum seems to be to prevent the separation of the two tendons from the edge of the groove in violent rotations of the arm.

846. The teres major may likewise move the scapula on the Os Humeri, by drawing the inferior angle downward, and bringing it nearer the arm; but, in order to this, the arm must be kept immoveable by some considerable force or resistance; as when in standing with the whole arm hanging down, the hand supports a great weight. By this action the teres major may likewise assist in raising the shoulder, or in hindering it from sinking.

847. The coraco-brachialis brings the arm to the fore-side of the thorax, raising it at the same time; and in this case it may be reckoned a congener or assistant to the pectoralis major in great efforts; and may perform the same motion by itself, when no great force is necessary; as when the whole arm hangs down, and is moved backward and forward like a pendulum, the motion forward being performed by the coraco-brachialis, and the motion backward by the teres major its antagonist.

848. This muscle may likewise move the scapula on the Os Humeri, kept firmly depressed, as when sitting in a chair we take fast hold of the edge of it with the hand. In this case the coraco-brachialis may bring the acromium downward, and the inferior angle of the scapula, near the vertebrae. It serves likewise to bring the arm to its former situation, after it has been turned by the latissimus dorsi, in order to apply the hand to the back; and then it turns the Os Humeri upon its axis in a contrary direction to that given it by the other muscle.

849. The supra spinatus is commonly supposed to join with the deltoides in lifting up the arm; this muscle beginning that action, and the deltoides continuing

continuing it. But besides that this muscle is very small, it seems to be too near the articulation of the head of the Os Humeri, to be able to raise the whole upper extremity, which is of a considerable weight and length. It has however two other very remarkable uses, when the arm is raised from the thorax to the head by the action of the deltoides.

850. To understand these uses, it must be remembered, (1.) That the cartilaginous convex part of the head of the Os Humeri is much larger than the glenoide cavity of the scapula. (2.) That the most superior part of this convexity lies out of the cavity when the arm is depressed or near the ribs. (3.) That the orbicular ligament of the joint is very broad, being proportioned to the distance between the edges of the convex part of the head of the Os Humeri, and of the glenoide cavity of the scapula and that therefore it cannot check the Os Humeri in any of its motions.

851. From thence it is plain, that the strong deltoide muscle in the first instant of its action to raise the arm, would thrust the head of the Os Humeri upwards out of the cavity; if something did not supply the place either of a bony fulcrum or ligamentary frænum. The arch of the acromium is of no use in this case; for the bone must be first luxated, before it can reach so far, and the neighbouring parts must suffer a friction, and even a contusion, which would be very prejudicial.

852. It is likewise plain that the broad orbicular ligament would be very apt to be entangled and bruised between the edges of the two articulated bones, were not this inconvenience prevented by some means or other; because it is not elastic enough to contract of itself in proportion as these two edges approach each other.

853. The supra-spinatus answers both these ends. When it contracts its tendon, which runs over the convex part of the head of the Os Humeri, to be inserted in the upper surface of the great tuberosity, it presses very strongly on the head of the bone, thereby supplying the place of a fulcrum, and hindering the head to rise, during the beginning of the action of the deltoides; and in this action, it is assisted by the ligamentary annular rope mentioned in the description of the fresh bones, No 250.

854. I find likewise in this muscle a singular contrivance to prevent the second inconveniency. Its tendon is a kind of band, which adheres closely to the outside of the orbicular ligament; and when we examine it narrowly, we observe that several of its fibres do not go so far as the head of the Os Humeri, but are gradually inserted in the outer surface of the ligament. These tendinous fibres are continuous with those which lie nearest the bone or bottom of the supra-spinal cavity of the scapula.

855. This portion may therefore be reckoned a distinct muscle belonging to the orbicular ligament, notwithstanding of its close union with the other portion, which is inserted in the Os Humeri. And indeed we might very justly establish a new species of muscles by the name of *articular muscles*, which belong chiefly to the capsular ligaments of those joints which have large degrees of motion; several examples of which we shall meet with hereafter.

856. The mechanism of this kind of muscles consists in this. The extremities of the tendons are inserted very obliquely in the surface of the ligament, and the fibres take up a great deal more space there, than in the body of the tendon; and they are commonly the innermost, or deepest and shortest portions of the ordinary muscles inserted near the articulations.

857. The use of these muscles, or portions of muscles, is to pull the orbicular ligaments uniformly, and thereby to prevent their running into irregular folds, and their being intangled between the two articulated bones.

858. The *infra-spinatus* being inserted by its tendon in the middle surface of the great tuberosity of the Os Humeri, must perform different motions according to the different situations of that bone. If it acts while the arm hangs down, parallel to the trunk of the body, it may move the Os Humeri round its axis from before outward, and consequently, if the fore-arm be at the same time bent, it will turn the hand from the body.

859. If while the arm is kept raised by the *deltoides*, the posterior portion of that muscle draws the arm backward; the *infra-spinatus* has the same use with respect to the orbicular ligament, as the *supra-spinatus* already described. And as these two muscles adhere closely by the edges of their tendons,

tendons, they may in some measure co-operate in their action, on that ligament.

860. When the arm, raised in the manner already said, is strongly pulled forward by the pectoralis major, a considerable force is necessary to prevent the head of the Os Humeri from being thrown backward out of the glenoide cavity. The structure of the infra-spinatus and the number of its fibres, which is much greater than in the supra-spinatus, fit it for answering this purpose; in which it is likewise assisted by the flat, broad, thin ligament mentioned in the description of the fresh bones, N^o 250. This muscle may likewise assist the teres major in great efforts.

861. The use commonly ascribed to the subscapularis, of pressing the arm against the ribs, from which it has the name of *porte feuille* in French, is *Subscapularis.* without foundation. When the arm hangs down in its natural situation, this muscle may turn it round its axis, from without forward, as it happens when in this situation, we beat the breast with the fore-arm bent; and it likewise strongly assists the latissimus dorsi, when we turn the hand behind the back.

862. When the arm being raised, we move it backward, as in giving a back-stroke with the elbow or fist; the subscapularis hinders the head of the Os Humeri from being luxated forward; for which purpose it is well fitted both by its structure and number of its fibres, this motion being sometimes performed with great violence.

863. It may likewise, by means of the nearness and lateral union of its tendon with that of the supra-spinatus, assist that muscle in keeping the head of the Os Humeri in the glenoide cavity, when the other extremity of the bone is raised.

864. The teres minor may turn the arm when depressed round its axis, from before outward; as it happens when the fore-arm being bent and applied *Teres minor.* to the lower part of the breast, is removed from thence, without moving the elbow from the side. This rotation is in a contrary direction to that performed by the subscapularis and teres major. x 2

865. This muscle may likewise pull the arm directly backward, whether raised or depressed; but in order to this, the sub-

subscapularis must act at the same time as a moderator to prevent the rotation. The co-operation of muscles is necessary in all particular motions, but in some more than in others.

§ 3. *Uses of the muscles which move the fore-arm on the Os Humeri.*

866. The biceps which I likewise name *coraco-radialis*, because one of its two superior insertions is in the coracoide apophysis, the other near the basis of that apophysis, moves the fore-arm in two different manners; that is, it bends both bones, and turns the radius upon the ulna; performing both motions by its insertion in the radius alone. It likewise moves the Os Humeri on the fore-arm, the scapula on the Os Humeri, and the Os Humeri on the scapula.

867. These five uses belong to this muscle, though it is commonly limited to that of bending the fore-arm; and to these we may add a sixth, by means of the passage of one of its superior tendons over the articulation of the Os Humeri with the scapula, through a ligamentary vagina which serves as a frænum, and may be looked upon as an annular ligament produced.

868. When it bends the fore-arm upon the Os Humeri, the scapula must be kept steady by the muscles which move it on the trunk; and in this function it is a congener or assistant to the brachialis, which is inserted in the ulna; and when the brachialis becomes incapable of acting by a wound or any other disease, the biceps alone may perform the flexion of the fore-arm, by being inserted in the radius, and by the connection of that bone with the ulna.

869. To be satisfied that it turns the radius, and performs the motion called *supination*, we need only consider the manner of its insertion in the tuberosity of the radius, already described, and then look on a skeleton: and even without these assistances the following experiment will prove this use.

870. If when the fore-arm is moderately bent, and in a pronated situation, we perform the motion of supination with the hand, and lay the other hand on the biceps at the same time, we will perceive it to swell and grow hard in proportion

tion as the supination advances. This muscle is therefore a true supinator.

871. The third use of the biceps which is to move the Os Humeri on the fore-arm, cannot have place till the fore-arm is fixed by some exterior force, as when we hold the branch of a tree with the hands, the arm being extended, and afterwards bend the arm in order to climb. In this case, part of the flexion is performed by the motion of the Os Humeri on the fore-arm. And though this whole action is not owing to the biceps, yet it as really contributes to it, as the brachialis.

872. The fourth use of the biceps is to move the scapula on the Os Humeri. In order to this, the whole arm must be kept fixed much in the same manner as was mentioned in describing a like use of the coraco-brachialis; whether this be done by any exterior resistance applied to the fore-arm or hand; or by pressing the two hands strongly against each other behind the lower part of the back. In these cases, the contraction of these muscles will draw down the acromia, and bring the bases of the scapulæ nearer each other.

873. The fifth use of this muscle is to move the Os Humeri on the scapula, by raising it much in the same manner as is done by the coraco-brachialis. The manner how this is performed, is easily conceived; as also that it is done most readily when the fore-arm is extended.

874. The particular use of the tendon which passes through the ligamentary vagina, over the articulation of the scapula with the Os Humeri, is to co-operate with the tendon of the supra-spinatus in hindering the head of the Os Humeri from getting out of the glenoide cavity, in the first efforts of the deltoides to raise the arm.

875. Though this tendon of the biceps be very small, and though it passes over a very smooth polished convex surface; yet it cannot slip to either side, because of the thick vagina which lies between the two tuberosities of the head of the Os Humeri, and there chiefly confines it. Besides, in proportion as the arm is raised, that part of the tendon which passes over the joint, becomes gradually shorter, because the frænum approaches, by the same degrees, to the place where it is inserted.

876. The

Brachialis. 876. The brachialis serves to bend the fore-arm on the Os Humeri, by its insertion in the ulna, and by the connection of that bone with the radius. It serves also to move the Os Humeri on the fore-arm.

877. The small lateral portions of the lower extremity of the fleshy body of this muscle. and the fleshy fibres between these portions, nearest the bone, are very short, and seem to make a distinct muscle, which does not reach to the ulna, but is inserted in the capsular ligament of the joint of the elbow.

878. These insertions in the ligament are very apparent in many subjects, and their use seems to be much the same with what I ascribed to the like fibres in the supra-spinatus, that is, to prevent the ligament from being caught and squeezed between the bones, in great flexions of the arm.

879. The anconæus maximus serves to extend the fore-arm, by bringing the ulna to a straight line with the Os Humeri. It serves likewise to extend the Os Humeri on the ulna, when the last named bone is fixed by some exterior resistance, as when being laid upon the ground, we rise by supporting ourselves on our hand. In this case likewise, the scapula must be kept steady by the coraco-brachialis.

880. It may likewise move the scapula on the Os Humeri by its insertion in the neck of the first of these bones, by means of which it may draw the basis downward and raise the top of the shoulder.

881. By its insertion in the scapula, it may likewise draw the arm backward in a more direct line than can be done by the teres major and minor.

882. The two lateral anconæi co-operate with and assist the anconæus maximus in extending the fore-arm on the Os Humeri, and the Os Humeri on the fore-arm.

883. The anconæus minimus may concur with the other muscles of that name, in extending the fore-arm on the Os Humeri, and the Os Humeri on the fore-arm; but its action does not reach to all the degrees of flexion of these bones; for when the fore-arm is very much bent, if we examine carefully the situation of this muscle, we will find it more disposed to maintain these

these bones in that posture, by co-operating with the brachialis, than to extend them by assisting the other anconæi.

§ 4. *The uses of the muscles which move the radius on the ulna.*

884. The supinator longus was believed to be concerned only in the motion of supination, till M. Heister very justly observed that it was likewise a flexor of the fore-arm. And indeed a very small degree of attention to its insertion and situation, must convince us that it is much better fitted for this last use than for the first. For before it can act as a supinator, the hand must be in the greatest degree of pronation; and even then it can do little more than bring the radius back to its natural situation, without completing the supination except it be by jerks. It would therefore be much more properly named *radialis longus*, than *supinator longus*. *Supinator longus.*

885. This muscle may bend the fore-arm by means of the connection of the radius with the ulna in several different situations, that is, when the fore-arm is fully extended, the radius being either in a motion of pronation or supination, or in a middle situation between both.

886. On this occasion it is proper to observe, that the method of examining the uses of the muscles on dead bodies, by pulling them in order to move the bones in which they are inserted, is very uncertain, except particular care be taken to pull them in their true natural direction, which is often different from what it appears to be when they are dissected, by reason of the lateral connections, fræna, &c.

887. Supination performed when the fore-arm is fully extended, is commonly attributed in part to the rotation of the Os Humeri, by means of its articulation with the scapula, as if this supination when the fore-arm is extended were greater than when it is bent; whereas the difference in supination is really but very small, though it be very considerable in the motions of pronation, as we shall see hereafter.

888. The supinator brevis seems to have no other use than what is expressed by its name; and as it is a short small muscle, it must be very weak. Its use is chiefly owing to the obliquity of its fibres; but still *Supinator brevis.*

neither this nor the former muscle would be able to perform supination, where a great force is required, without the assistance of the biceps, which is the most powerful of all the supinators, and the chief actor in this motion, as I have already proved.

889. The pronator teres can have no other action but that of pronation, in the different situations of the radius, whether that bone be in a middle state between pronation and supination, or in the greatest degree of supination; and in this case, though it is but a small weak muscle, it overcomes the supinator longus.

Pronator teres. 890. The pronator quadratus is capable of no other motion but pronation, and it acts with much more force than its congener the pronator teres; both because of the number and direction of its fibres, and because it acts upon the radius near the lower extremity, where its effects in pronation are much greater than if it acted near the head of that bone. The fibres lie almost in the same direction in which the bone moves; and in this it has the advantage not only over the other pronator, but over all the supinators, the biceps itself not excepted.

891. The fibres of which this muscle is composed are so disposed as that the longest adhere to the internal angles of both bones of the fore-arm; the shortest lie nearest the interosseous ligament, and the intermediate fibres are longer or shorter according to their greater or less distance from the ligament.

892. By these different degrees of length, the whole number of fibres is advantageously disposed, and their action rendered uniform. In the greatest degree of supination, the extremity of these fibres inserted in the two bones makes a very oblique plane, which becomes almost straight in the greatest degree of pronation. We shall have other examples of this kind of mechanism hereafter, and it shall then be explained and accounted for.

Remarks on the motions of pronation and supination. 893. The motions of pronation and supination are commonly attributed to the radius alone; and the ulna is believed to have no other share therein, than to serve as a fulcrum or basis on which these reciprocal turns or rotations of the radius are made;

made; and lastly, these motions are said to be the effects of four muscles, or at most of five, the biceps being included.

894. Anatomists likewise pretend that they have seen others demonstrate; that they have demonstrated themselves; and that they are able at any time to demonstrate, both on the skeleton and on fresh subjects, these two reciprocal motions, without any motion in the ulna; and they have even gone so far, both in public and private, as to make experiments on their own arms, to prove that the radius alone performs these motions, and that the ulna has no share in them.

895. All this notwithstanding, I have observed and demonstrated to the royal academy of sciences, that in these motions, when free and unconstrained, the two bones of the fore-arm move always at the same time. Thus, for instance, when we turn the radius toward the breast in pronation, the ulna is at the same time turned from the breast; and when we turn the radius, from the breast in supination, the ulna is at the same time brought nearer it, supposing in both these motions that the fore-arm is bent.

896. In these motions the radius rolls simply from one side to the other; its extremity in a complete pronation or supination, describing a kind of semicircle; and at the same time the extremity of the ulna moving in a contrary direction describes another semicircle. Thus in proportion we raise the extremity of the ulna, and remove it from the breast at the same time; and in supination we first depress it, and then raise it again, as it is brought nearer the breast.

897. Neither is this all; for these small motions of raising and lowering, of adduction and abduction in the extremity of the ulna, cannot be brought about without the rotation of the Os Humeri, because of the ginglymus by which these two bones are articulated. Therefore in all unconstrained pronations and supinations, three bones must move, and all the muscles concerned in these motions must act; and likewise, during this action, the scapula must be kept fixed.

§ 5. *Uses of the muscles which move the carpus on the fore-arm.*

898. The motion of the carpus is made principally on

the extremity of the radius; and on the ulna, only by the intervention of the interarticular cartilage or cartilaginous production of the radius. We are not to have regard only to the carpus in general in these motions, because some of them relate also to the metacarpus, and others to particular bones of the carpus. The motions of the carpus affect likewise the whole hand, which is thereby carried different ways, and put in different situations.

899. The chief motions of the carpus are expressed by terms not altogether proper, but which may be retained, as having been long in use, provided they be well explained to those who are not accustomed to them. Turning the hand toward the inside of the two bones of the fore-arm, is called *bending the wrist*; and the wrist is said to be extended when the hand is turned toward the outside of the fore-arm. When it is turned toward the radius alone, that motion is termed *adduction* with regard to the Os Humeri; and *abduction* in the same sense, is when the hand is turned toward the ulna alone.

900. These motions are attributed to four muscles; the ulnaris internus, radialis internus, ulnaris externus, and radialis externus, or bicornis. Flexion is performed by the two internal muscles; extension by the two external; abduction by the two ulnares, and adduction by the two radiales.

901. These muscles may likewise successively perform several subaltern or oblique motions of the carpus and hand, by the combination of two principal or direct motions. Thus, the radius being fixed in its natural situation between pronation and supination, we may, by a motion of flexion and abduction together, turn the hand obliquely, and at the same time partly towards the fold of the arm, and partly toward the external condyle.

902. These combined motions cannot however be performed with near so much freedom as the simple motions of flexion, &c. because of the oblong figure of the joint of the wrist; and the ease and readiness with which they seem to be performed, is owing to the assistance of the motions of supination and pronation.

903. When the ulnaris internus acts alone, or as
Ulnaris internus. the principal mover, it brings the hand obliquely toward

toward the internal condyle, and toward the olecranon, though with difficulty, for the reason already given.

904. When it acts together with the *radialis internus*, it turns the hand equally towards the two extremities of the bones of the fore-arm; and thereby moves not only the carpus in general on the fore-arm, but also the second row of the carpus on the first, and the metacarpal bones on the second.

905. When it acts with the *ulnaris externus*, it turns the outer edge of the hand toward the olecranon.

906. When the *ulnaris externus* acts with the *ulnaris internus*, it turns the outer edge of the hand toward the olecranon, as already said. *Ulnaris externus.*

907. With the *radialis externi*, it turns the back of the hand toward the outer condyle. This motion is termed *extension*, but very improperly when applied to the hand; for the metacarpus which is naturally bent this way, will be still more bent by the action of these muscles. I should chuse therefore to term this motion the *inversion* rather than the *extension of the hand*. The carpus indeed may in some sense be said to be extended, because the bones of the second row are brought to a straighter line with those of the first.

908. When this muscle acts alone, it brings the outer edge of the hand obliquely toward the olecranon and the external condyle at the same time; but this is performed with difficulty, as has been already observed.

909. The *radialis internus*, together with the *ulnaris internus*, has the uses already mentioned. *Radialis internus.*

910. With the *radialis externus*, it carries the inner edge of the hand, or that next the thumb, towards the extremity of the radius, and toward the fold made by the ulna and Os Humeri.

911. Alone, it moves that part of the hand which is next the thumb obliquely, toward the internal angle of the radius, but with the same difficulty as the rest, when they act singly.

912. It seems likewise to deserve the name of a *third pronator*. What first gave me a notion of this use was the consideration of the obliquity of its direction between its two insertions, which is greater in proportion than that of the *supinator longus*, which therefore must be less fitted for *supination*, than the other is for *pronation*. I look upon the annular

nular ligament through which the tendon of the radialis internus passes, as a sort of insertion with respect to the direction of the muscle, and we plainly perceive the tendon to be stretched in a strong motion of pronation.

913. The radialis externus, together with the radialis internus, turns the inner edge of the hand directly toward the styloide apophysis of the radius.

914. With the ulnaris externus it inverts the hand, turning the convex side of the metacarpus toward the lower extremity of the bones of the fore-arm. It likewise moves the second row of the carpus on the first, and thereby increases the transverse fold on the convex side of the carpus, mentioned in the general observations on the situation of the bones of the upper extremity. This motion likewise increases the angle which the back of the hand naturally makes with the outside of the fore-arm; and therefore, according to the common language, it would be more properly termed a flexion outward than an extension.

915. This muscle acting alone draws obliquely, and toward the external angle of the radius, that portion of the hand which answers to the first metacarpal bone and to the index; but this is done with the same difficulty that has been already taken notice of in the other muscles.

916. Each of the two radiales externi may act separately, and consequently have distinct uses, since their tendons having passed the annular ligament, are inserted at some distance from each other; and thereby one of them seems to be fitted to co-operate with the radialis internus, the other with the ulnaris externus; and they both serve conjointly to keep the hand in its true natural situation mentioned in the description of the skeleton.

917. The ulnaris gracilis, commonly called *palmaris longus*, seems to be an assistant to the ulnaris and radialis interni in bending the wrist; and it seems likewise particularly to assist the radialis internus in the motion of pronation.

918. The metacarpus serves to turn the fourth bone of the metacarpus toward the thumb, and at the same time to increase the convexity of the back of the hand, which is called *making Diogenes's cup*. The fourth bone thus moved carries the third along with it by reason

reason of their connection, which still augments the hollow on one side, and the convexity on the other.

§ 6. *Uses of the muscles which move the fingers.*

919. The perforatus serves to bend the second phalanges of all the fingers except the thumb; and the particular muscles of which it is made up, may act *Perforatus.* separately, by reason of their distinct insertions in these phalanges. The union of the fleshy bodies by middle tendinous septa may have several uses; the chief of which is, that these septa being very broad and thin, give insertion to a great number of fleshy fibres in a very small compass, and thereby supply the place of four large tendons, which would have taken up much more room; but, by this union, these four muscles are more disposed to act jointly than separately.

920. They not only bend the second phalanges on the first, but also the first on the metacarpal bones, and the metacarpus and carpus on the fore-arm. To conceive the mechanism and force of these muscles, which is very great and necessary in certain circumstances, we must call to mind an observation already made concerning the muscles of the scapula; that every muscle which can move a bone in any given direction, is likewise able with the same force to keep it immoveable in any situation against whatever tends to move it in a contrary direction. The following examples will sufficiently illustrate this observation.

921. It is by bending the fingers that we raise the greatest weights, that sailors pull large oars, that printers turn the screws of their presses, and that climbers support their whole bodies even with an additional burden upon them. It is by means of the fingers when bent, that we tear, pull up, bruise, &c. things that require a very great force to tear, pull up, or bruise them.

922. I observed in the beginning of this description of the muscles, N^o 54. 55. that the strength of muscles depends on the multitude of their fleshy fibres, and the extent of their motions, on the length of these fibres; and consequently wherever strength is more necessary than large degrees of motion, there we find the fibres of muscles proportionably increased in number; and wherever there is more occasion for

a large degree of motion than for strength, the fleshy fibres are of a proportionable length.

923. In the perforatus we meet with both these contrivances, a great number of fibres for strength of motion, and a great length of fibres for extent of motion. The different tendinous septa serve to give insertions to a number of moving fibres sufficient for the strength required in the cases already mentioned.

924. Large degrees of motion are likewise sometimes very necessary in this muscle, as for instance, when we bend the fingers at the same time that the metacarpus and carpus are bent on the fore-arm; and in this case certain fasciculi of fibres are chiefly employed, which appear to be longer than the rest.

925. The particular use of the tendons of this muscle will be better understood with that of the perforans.

926. The perforans bends particularly the third phalanges in which it is inserted; and by the same motion *Perforans.* it may likewise bend the first and second phalanges. We may apply to this muscle all that has been said concerning the tendinous septa in the perforatus, and concerning its action, which is sometimes common to all the four subaltern muscles, sometimes peculiar to one or more of them.

927. It may likewise be esteemed an assistant to the ulnaris and radialis interni in great efforts; and these muscles may be reciprocally looked upon as assistants to the perforatus and perforans.

928. Each of these four tendons passes under a distinct annular ligament as under a pulley; for having accompanied that of the perforatus through the great ligament of the carpus, through the furcæ of the aponeurosis palmaris, and through the ligamentary vaginæ of the first phalanx, and having passed through the slits of the perforatus, it leaves this tendon, and continues its course to the third phalanx through the ligamentary vagina of the second.

929. In its passage through the slit of the perforatus, it is liable to no compression even in the most violent efforts of that muscle. The reciprocal contortions of the two flat portions of the fissure, and their crucial insertion in the flat side of the third phalanx, hinder the little oblique grooves mentioned in the description, from closing, and the two lateral portions

portions of the fissure from coming together, even after the tendon of the perforans has been removed. And the more this part of the tendon is pulled, the more perfectly does the fissure form a sort of channel with solid sides, and with the two ends cut obliquely. All this I demonstrated in the royal academy on a fresh subject, and I imitated it artificially with a riband.

930. Without such an artful structure as this, the tendon of the perforans would have been continually exposed to compressions and contusions by the sides of an ordinary fissure; without passing through the tendon of the perforatus, it could not have been inserted in the middle of the flat side of the third phalanx, but near one of the edges.

931. In the insertion of these two tendons of the phalanges, we may observe still a farther contrivance. This insertion is angular in both, that is, the extremities of the tendons are not inserted according to their breadth, in a transverse line, but the sides of their breadth make an angle with the middle. I omitted this circumstance in the description, for fear of running out to too great a length, a treatise which is designed more for instruction than for curiosity.

932. The extensor digitorum communis serves to extend the four fingers, to keep them in any degree of extension, and to moderate their flexion in all the determinate degrees of action of the perforatus and perforans. The composition of the fibres of this muscle, and its division into several subaltern muscles, are much the same with what we have already seen in the two former. Each of these subordinate muscles may act separately, but with more difficulty than the other two, because of the collateral series between the tendons.

Extensor digitorum communis.

933. The particular use of these communicating portions, is to move the fingers laterally, when extended, to draw them nearer or to a greater distance from each other, and also to serve as fræna instead of vaginæ. These motions being unnecessary when the fingers are bent, the perforatus and perforans have none of these communicating portions.

934. Each tendon serves to extend a whole finger, that is, all the three phalanges together; and likewise each phalanx by itself, though not with the same facility. The three phalanges being bent, we can easily extend the first without

the other two, but it is difficult to extend the second phalanx without extending the third.

935. The contrivance for the general extension of the three phalanges by one tendon, consists chiefly in the rhomboidal fissure in that tendon on the second joint, or that of the second phalanx with the first, and in the tendinous expansions on the sides of the bases of the first phalanx. To these we must add a short tendinous production from the inside of the tendon near the first angle of the rhomboidal fissure, inserted in the basis of the second phalanx. This production I omitted in the description.

936. The lateral expansions extend the first phalanx, the production just mentioned extends the second, and the last angle of the rhomboidal fissure, the third; two other angles being kept separate by auxiliary muscles, of which hereafter.

937. The difficulty we find in extending the second phalanges without extending the third, and in extending the third without the second, is partly owing to the two strong flexors inserted in these phalanges, which are seldom contracted or relaxed separately without a particular habit; and it is for the same reason that we cannot easily bend one of these phalanges without bending the other, except we have been long accustomed to it.

938. The proper extensors of the fore and little fingers are

*Extensores indicis et
minimi digiti proprii.*

assistants to two subaltern muscles of the extensor communis that go to these fingers, which consequently we extend separately with more ease, than either of the other two. These muscles likewise serve to bring the fingers in which they are inserted nearer the other fingers.

939. We may be convinced of this last use, by touching these muscles when we hold our fingers close together, or move them laterally, whether extended, or in any other unconstrained posture between extension and flexion. The same experiment may be made with relation to the middle and ring fingers.

940. Among the long muscles which cover the bones of

*Remarks on the situation
of the long muscles which
lie upon the fore-arm.*

the fore-arm, those which extend the carpus and fingers are fixed in the outer condyle of the Os Humeri, or

near

near it on the same side. Those which bend the same parts, are fixed in the internal condyle, or near it on the same side.

941. This disposition is very favourable to the action of the pronators and supinators, which otherwise must have been obstructed, and these muscles must likewise have hindered the action of the flexors and extensors; and they would mutually have been exposed to contusions and bruises.

942. For were the flexors fixed on the side of the external condyle, they must cross over the radius, because of their insertions near the palm of the hand; and if the extensors were fixed near the internal condyle, they must cross over the ulna in pronation, and in that case could not act freely.

942. The flexor pollicis longus serves chiefly to bend the third phalanx of the thumb in which it is inserted by the extremity of its tendon. *Flexor pollicis longus.*

It likewise bends the second phalanx, by virtue of the ligamentary vagina through which it passes, as through an annular ligament.

944. As the fleshy body of this muscle is very thin and narrow, it does not at first sight appear to bear a sufficient proportion to the great force with which we constantly find it to act. But when we consider its structure more narrowly, we find therein a beautiful example of a very great number of fibres, artfully placed in a small space, only by the oblique distribution thereof; as I observed in the beginning of this treatise of the muscles, No. 14. 54. 55.

945. The first extensor of the thumb alone, when there are three, or a portion of the first, when there are but two, serves to draw the first phalanx from the palm of the hand, or to keep it at a distance therefrom. *Extensores Pollicis.*

946. The word *extension* made use of to express this motion is very improper; for the first phalanx of the thumb in its natural situation makes an angle with the radius, and consequently is in a state of flexion. It ought therefore more properly to be said to be extended when it is drawn near the palm of the hand. However the common terms may still be retained, if we be previously made acquainted with their true meaning, as I already observed, speaking of the uses of the ulnaris and radialis externi.

947. The second of these muscles when there are three,

or the second portion of the first, when there are but two, serves to extend the second phalanx on the first, and this motion is a true extension.

948. The third, when there are three, or the second, when there are but two, extends the third phalanx on the second.

949. When they act all together, they assist each other by the graduated insertions of their small subaltern tendons.

950. These muscles may likewise assist in the common action of the two radiales, that is, in bringing the great or inner edge of the hand towards the convex side of the radius; and they probably have some share likewise in the motion of supination.

§ 7. *Uses of the small muscles inserted in the bones of the metacarpus and fingers.*

951. The thenar, by its insertion in the first phalanx of the thumb, serves to draw it from the first bone of the metacarpus, more or less directly, as one of its portions acts more than the other, or as they both act equally.

952. By the insertion of the large portion in the basis of the second phalanx by the intervention of the sesamoide bone of the same side, it may bend this phalanx laterally on the first, and thereby bring the thumb to a greater distance from the index. Neither does this distance hinder it from sometimes bending, and sometimes extending the thumb in the ordinary manner.

953. When the small portion acts alone, it may give the second phalanx a small degree of rotation on the first, these two bones not being articulated by a ginglymus.

954. The Mesothenar moves the first phalanx of the thumb towards the hollow of the hand, more or less obliquely, as it acts either alone or with the large portion of the thenar, or even with the antithenar. By its insertion in the sesamoide bone of the second phalanx, it likewise moves that phalanx on the first, and thereby assists the flexor longus.

955. The antithenar moves the first phalanx of the thumb toward the first bone of the metacarpus,

carpus, and thereby presses the thumb laterally against the index. This motion becomes more or less oblique by the co-operation of the mesothenar.

556. The hypothenar minor serves to separate the little finger from the rest; which motion is commonly called *abduction*. It likewise keeps this finger separated in all situations, that is in all degrees of flexion or extension. *Hypothenar minor.*

957. The interossei may have two different uses according to their different insertions, and the different situations of the fingers in which they are inserted. *Interossei.*

958. In general, they assist the extensor communis by their insertions in the lateral angles of the rhomboidal fissures; for thereby they act like lateral ropes, which, together with the tendons of the extensor, serve to extend the third phalanx of each finger.

959. By the same lateral insertions they perform the lateral motions of the fingers, that is, they press them all close against each other, but do not separate them all, nor move each finger in particular towards or from the thumb. In a general separation of all the fingers, the interossei move only the middle and ring fingers; the index and little finger being separated by other muscles. In the motion of the fingers toward the thumb, which is termed *adduction*, they act only on three fingers, the middle, ring, and little fingers. In the contrary motion, or abduction of the fingers, they move likewise three viz. the index, middle, and ring fingers.

960. The uses of the interossei in particular, whether external or internal, may be different in different subjects, according to the variety of their insertions, and therefore in living bodies nothing can be determined about them.

961. According to the situation in which I have described them, the first and second external interossei perform alternately the adduction and abduction of the middle finger; the third performs the abduction of the ring finger; that is, moves it toward the little finger.

962. The first internal interosseus makes the abduction of the index, or moves it toward the middle finger; the second makes the adduction of the ring finger, by moving it likewise toward the middle finger; and the third performs the adduction

tion of the little finger, or moves it toward the middle finger.

963. Heister in his *Compendium Anatomicum* published 1727, p. 316. makes me say that the internal interossei, by their insertions in the ring and little finger, perform the abduction of these fingers; adding, that he does not conceive how an internal interosseus muscle can perform the abduction of the little finger, since by that term anatomists understand a motion from the thumb. He quotes for this, the memoirs of the royal academy for the year 1720, but it is plain he had not seen the Paris edition, and that in that which he consulted, *b* had been substituted for *d*.

964. The use of the semi-interosseus indicis is to move the first phalanx of the index more or less directly toward the great edge of the metacarpus, by removing it from the middle finger. This motion is not a true adduction of the index toward the thumb. And indeed the terms of adduction and abduction are very improper to convey a just idea of the lateral motions not only of the index, but of all the other fingers.

965. The Lumbricales, by the union of their tendons with those of the interossei, are coadjutors to these muscles, not only in the lateral motions of the four fingers, but also in bending and extending them. In the lateral motions, they co-operate according to their situation in each subject; and it is possible, that the variety of their insertions answer to that of the interossei, so that the reciprocal co-operation continues still to be equal.

966. They assist the great common flexor to which they are fixed, only in bending the first phalanges; which motion that muscle principally performs by means of the ligamentary vaginae, especially that portion of them which is next the metacarpus.

967. They may assist the extensor communis in extending the third phalanges, together with the interossei, by the concurrence of their tendons. But here the variety of their insertions is likewise to be regarded; and in some subjects the want of them in that side of the index next the thumb, and side of the little finger furthest from the thumb, may be supplied by the proper extensors of these fingers.

§ 8. *Uses of the muscles which move the Os Femoris on the pelvis.*

968. The glutæus maximus serves chiefly, by its posterior portion, to extend the Os Femoris, and to draw it backward. Neither of the other glutæi can have this use, though it is commonly attributed to all the three. By its anterior portion, it may co-operate with the rest in performing the abduction of the thigh, that is, in separating it from the other when we stand; but when we sit, it can do this office only by its posterior portion.

Glutæus maximus.

969. By its insertion in the Os Coccygis, it may on some occasions bring it forward, and hinder it from being thrust too far backward, as in the excretion of hardened fæces, or in difficult births.

970. The glutæus medius is commonly, but falsely reckoned an extensor of the thigh. Its use is to separate one thigh from the other, when we stand, and that more or less directly according to the action of its anterior, posterior, or middle portions. In this situation therefore it is a true abductor, but by only viewing its insertions we may be assured that it cannot be an extensor.

Glutæus medius.

971. When we sit, the only use of this muscle is to perform the rotation of the Os femoris about its axis, in such a manner, that if the leg be bent at the same time, it shall be separated from the other. This rotation is not altogether direct, but must be more or less oblique, because of the crookedness of the bone, and of the angle which its head makes with the body.

972. The glutæus minimus has likewise been reckoned an extensor of the thigh, but without any foundation. It assists the glutæus medius in the abduction of the thigh when we stand, and in the rotation when we sit. Therefore of these three muscles commonly called *extensors* of the thigh, only one deserves that name.

Glutæus minimus.

973. What I have said of the use of these muscles when we stand, will equally hold in all other situations in which the thighs are stretched out; as for instance, when we lie at full length.

Remarks on the uses of the glutæi.

And

And what has been said of their uses when we sit, will agree to all other situations in which the thighs are bent, as when we lie with the knees drawn up toward the abdomen.

974. The glutæi not only perform these motions of the thigh on the pelvis, but reciprocally move the pelvis on the thighs in the same manner. The glutæus maximus, for instance, not only extends the Os Femoris, but sustains the pelvis on the thighs, and hinders it from being carried along with the rest of the trunk when the body is inclined forward, while we stand; and likewise raises it, when the rest of the body is raised.

975. The other two glutæi likewise move the pelvis on the thigh as they move the thigh on the pelvis. For instance, when we stand upon one leg, the two muscles on that side draw the pelvis laterally toward the thigh, and hinder it from giving way or falling toward the other side, whether the weight of the pelvis itself, and of the other leg which is not supported, endeavours to bring it.

976. The psoas bends the thigh on the pelvis, or brings it forward. It may likewise move the pelvis on the thighs, and hinder it from being carried along with the rest of the trunk, when the body is inclined backward while we sit, having the lower extremities fixed by some external force. In this situation it may likewise move the vertebræ of the loins.

977. The iliacus is a congener or assistant to the psoas, in bringing the thigh forward and upward. It may likewise move the pelvis in the same manner with the former.

978. The pectineus is an assistant to the two former muscles in moving both the thigh and the pelvis. It may likewise assist in bringing the thigh inward, or toward the other, whether it be extended or bent at the same time.

979. The three triceps muscles join in the same use, that is, to move the thigh inward, and bring the two thighs near each other; as when in riding, we press the thighs close against the saddle; when in sitting, we hold any thing close between the knees; when we cross the thighs; or when in standing, we bring the legs close together in order to jump.

980. The

980. The use of these muscles is likewise to hinder the thighs from separating more than is convenient, especially in great efforts and jerks. This might happen, for instance, when in mounting a horse, or laying the leg over any height, we raise one thigh hastily, and support the body on the other. It might likewise happen by the weight of the body alone, when in standing we separate both legs at once, or jump hastily to one side.

981. This use of bringing the thighs together, and hindering their separation, has place in all possible situations of the body or thighs, that is, in standing, sitting, and lying, and when bent, extended, or turned backward or outward. This shews the great necessity of providing for this function, not only by a strong moving force, but also by distributing this force in such a manner, as that it may be able to act through almost all the degrees of a very long lever of one kind.

982. The longest portion of the triceps tertius being inserted in the side of the inner condyle of the Os Femoris, seems to counterbalance the other portions which are inserted more posteriorly in the linea aspera.

983. These four muscles, called likewise by the common name of *quadrigenini*, are congeneres in their uses; and these have been confined by anatomists to the rotation of the Os Femoris about its axis from before outwards. I demonstrated many years ago, that they cannot have this use, except when we stand or lie at full length; and likewise that in sitting, or when the thigh is bent in any other posture, they carry the thigh outward, or separate the two thighs from each other when bent.

984. All the four co-operate in these two uses of rotation and abduction; but they co-operate equally or unequally, according to the different degrees of the extension or flexion of the thigh. For instance, when we stand straight up, they all perform the rotation equally; but if the thigh be then carried a little forward, the *pyriformis* is more in action than the *quadratus*; and if the thigh be carried backward, the *quadratus* acts most.

985. These muscles, by means of their adhesion to the orbicular ligament of the joint of the hip, may likewise serve

to hinder that ligament from being squeezed between the bones in the different motions of the thigh.

986. The obturator internus has nearly the same uses with the quadrigemini, in making the rotation of the thigh when extended, and the abduction, when bent. But the mechanism of this muscle is singular in this respect, that, by the passage of its tendon, over the small ischiatic notch, it acquires a different direction from that of the belly or fleshy body.

987. This notch supplies the place of a pulley, over which a rope is thrown, one end of which is fastened to a moveable object, which, by pulling the other end, may be brought nearer the pulley. In this the pulley performs the office of a fixed point or fulcrum with respect to the moveable body; and in like manner the ischiatic notch is a fulcrum for the motion of the thigh by the obturator internus.

988. The obturator externus concurs with the internus in the same uses, though in a more simple manner, and in a more uniform direction. It acts chiefly when the thigh is extended more or less; for when the thigh is bent, it only seems to co-operate with the obturator internus in its action on the orbicular ligament; because in other respects, it is rather an assistant to the triceps, and performs the motion of rotation the other way.

989. The musculus fasciæ latæ has been falsely supposed to be an abductor of the thigh; for the direction of its moving fibres is very contrary to such a motion. It is very proper for making a rotation from before inwards, that is, in a contrary direction to that made by the quadrigemini and obturator internus; and this rotation is not so much confined as that of the quadrigemini, because it may have place whether the thigh be bent or extended.

990. It may likewise assist in the great efforts of flexion or adduction, provided that its different antagonists act as moderators, according to the different situations of the thigh, as shall be explained at more length in another place.

§ 9. *Uses of the muscles which move the bones of the leg on the Os Femoris.*

991. To be able to conceive the uses of these muscles, we ought first to be well instructed in all that relates to the bones concerned, especially their articulations and intermediate cartilages, as I have described them in the treatise of the skeleton, and of the fresh bones; and in particular, I desire the reader to review the description of the Os Femoris, tibia, and patella.

992. The two vasti and crureus ought to be looked upon as a true triceps, the uses of which, in relation to the bones, are only to extend the tibia on the Os Femoris, and the Os Femoris on the tibia. The extension of the tibia on the Os Femoris, happens chiefly when we sit or lie, and that of the Os Femoris on the tibia, when we stand or walk. All the three muscles move the patella uniformly in the direction of the Os Femoris, on the pulley at the lower extremity of that bone. The external or broad portion of this pulley and of the patella, answers to this direction, and seems to be more exposed to the action of these muscles, than the internal and narrow portion on which the necessary obliquity of that pulley depends.

*Vastus externus,
vastus internus,
and crureus.*

993. The insertion of both the vasti immediately in the head of the tibia, prevents the patella from being luxated laterally on some occasions, in which the muscles may act with more force on one side than on the other, or remain without action, in which case the patella is loose and floating.

994. To be convinced of this inaction, and of the moveableness of the patella at the same time, let us, either in sitting or standing with the leg extended, rest the leg only upon the back side of the heel, so as that the whole lower extremity may be supported on the heel and on the head of the Os Femoris, the knee and the body of the Os Femoris resting on nothing, and the extension being made only by the weight of the bones without any assistance from the muscles. If, in this situation, we lay the thumb on the basis of the patella and the fore-finger on the apex, and press these two parts al-

ternately, the patella will be perceived to be raised and depressed.

995. In the description of these muscles, I forgot an observation which I have made on the insertion of several fibres immediately in the capsular ligament of the joint of the knee. I have seen these fibres run down, as if they came chiefly from the crureus; and their insertion in the ligament was oblique, and made by degrees. And from hence I first took the hint of that new species of muscles already mentioned in describing those which surround the articulation of the head of the Os Humeri, of the ulna, and of the Os Femoris; and in some articulations the adhesion of the tendons or tendinous fibres supplies the place of fleshy fibres.

996. By the insertion of these muscles in the patella, their line of direction is removed to a greater distance from the centre or axis of motion of the joint, which facilitates their action, and defends their common tendon from compression and contusions.

997. The rectus anterior by its insertion in the patella is a congener to the last three muscles, and serves
Rectus anterior. to extend the leg. By its insertion in the Os Ilium, it bends the thigh and assists the psoas iliacus, and pectineus, whether the leg be extended or bent. It likewise moves the pelvis forward on the Os Femoris, and hinders it from falling back when we sit.

998. Being partly penniform and partly simple, it is capable of sustaining great efforts, and of producing large motions; and its line of direction which is raised to a considerable distance from the centre of motion of the hip and knee, increases these advantages. The particular disposition and largeness of its second superior tendon, answer principally to all the degrees of flexion.

999. The other tendon commonly described, would not alone have been sufficient for that purpose; but its obliquity is convenient for the extension of the leg, when the thigh is extended or but little bent. But when the thigh is very much bent, this obliquity would remove the small tendon to too great a distance from the bone, and thereby expose it to be torn off, in the same manner as we tear off the branch of a tree, by separating it from the trunk. The obliquity here mentioned,

mentioned, is with respect to the Os Femoris, this superior tendon lying out of the direction of that bone.

1000. The sartorius performs the rotation of the thigh from before, outward, whether extended or bent, being an antagonist to the musculus fasciæ latæ, and a congener to the quadrigemi. *Sartorius.*

1001. If during this rotation the leg be extended, the toes are turned outward; but if the leg be bent, it is turned toward the other leg, as when we lay it over the other leg or knee, in the manner that tailors sit at work, from whence this muscle got the name of *sartorius*.

1002. It likewise bends the thigh or raises it forward; it moves the pelvis forward on the Os Femoris, and when the pelvis rests on the two tuberosities of the ischium in sitting, it keeps it in that situation. In this action it is a congener to the rectus anterior, but acts with much more force, as having its line of direction further from the centre of motion.

1003. Lastly, it bends the leg, whether it performs the rotation of the thigh at the same time or not. In this latter case, it is directed by the co-operation of some congener, or counterbalanced by the action of the musculus fasciæ latæ.

1004. The length and obliquity of its fleshy portion, the passage of the inferior tendon through the aponeurotic vagina, the particular insertion of this tendon, and the extent of the aponeurosis which it sends over the tibia, contribute very much to these different uses.

1005. Besides all these uses, it may in some cases assist the popliteus, as shall be shewn in speaking of that muscle.

1006. The gracilis internus bends the leg much in the same manner with the sartorius which it assists in this function, but not in that of turning the leg; and it is more proper to continue the flexion than to begin it, it being chiefly when the thigh is turned by the sartorius, that the gracilis contributes to this action. *Gracilis internus.*

1007. It may likewise assist the triceps in the adduction of the thigh, which it performs with much more facility than it begins the flexion of the leg without the rotation of the thigh. This facility in all situations of the thigh, is procured by the distance of the superior insertion of this muscle from the joint of the hip; but it cannot with the same ease bend the leg when the thigh is not turned, for this reason.

1008. While

1008. While the thigh is only extended, the line of direction of this whole muscle is nearly in the same plane with the axis of motion of the knee, and therefore the distance of its superior insertion gives it no advantage. But when the thigh is turned round by the sartorius, the plane of its direction changes and crosses the axis of the ginglymus of the knee, and then the lateral distance of its superior insertion facilitates its action on the leg.

1009. The semi-nervosus bends the leg, and may likewise bend the thigh on the leg. By its insertion in the tuberosity of the ischium, it likewise extends the thigh on the pelvis, and carries it backward; and may also extend the pelvis on the thigh, when it has been inclined forward with the rest of the trunk; and consequently prevent its being carried too far along with the trunk, when we stop forward, either standing or sitting.

1010. The semi-membranosus has the same uses with the semi-nervosus. It bends the leg on the thigh, and the thigh on the leg; it extends the thigh on the pelvis, and the pelvis on the thigh, and sustains the pelvis when it is inclined forward. It differs in this one thing from the three muscles last mentioned, that its insertion is not on one side, but behind the joint; and for that reason it is better disposed both to begin and continue the flexion of the leg than they are.

1011. The two portions of the biceps bend the leg on the thigh, and the thigh on the leg. The superior portion likewise extends the thigh on the pelvis, and the pelvis on the thigh. These four uses in general are common to this muscle with the semi-membranosus, and in some measure with the semi-tendinosus.

1012. The particular use of the biceps, and which seems to belong more to the short portion than to the other, is to perform the rotation of the leg when bent, by which motion the toes are turned outward, and the heel inward. It has no share in the rotation of the leg when extended, which depends entirely on that of the thigh, the motions of which, the leg only follows, as if these two bones were cemented together.

1013. The mechanism of the rotation of the leg when bent, depends chiefly on the structure of the semi-lunar cartilages,

tilages, and on the situation of the lateral and crucial ligaments. These cartilages are hollowed on the upper side in proportion to the convexity of the condyles of the Os Femoris; and on the under side they are flattened in proportion to the surface of the tibia. The lateral ligaments are not in the middle of each side of the head of the tibia, but more backward. The crucial ligaments are disposed in such a manner, as that in turning the leg when bent, from before outward, they separate from each other, and in turning it from before inward, they approach each other. See the description of the fresh bones, N^o 154. 160. 162.

1014. When the leg is extended or bent, the semi-lunar cartilages perform the office of hinges, because the condyles of the Os Femoris turn in their cavities; and in this case these cartilages may be considered as making in some measure but one piece with the tibia. And when the leg is strongly extended, the lateral ligaments, by their situation backward, limit this extension, and hinder the leg from being bent forward.

1015. In making the two motions of rotation with the leg when bent, the semi-lunar cartilages may be considered as being fixed to the Os Femoris, and that the tibia slides both ways under them. In this case, the lateral ligaments are very much relaxed, and nowise hinder this rotation; and the crucial ligaments separate from each other, when we turn the toes outward, the leg being bent; but they strike against each other, when the toes are turned inward, which seems to render the rotation inward, more confined than the rotation outward.

1016. These two reciprocal motions of the leg when bent, may be compared to those of the radius on the ulna. The rotation inward answers to pronation, and the rotation outward to supination. The biceps of the tibia may be likewise compared to the biceps of the fore-arm, both being flexors and rotators; for pronation and supination are only two species of rotation.

1017. The want of motion in the fibula on these occasions, is made up by the moveableness of the patella; without which the rotation of the leg, when bent, would be impossible; for in making this motion, the patella remains perfectly at rest on the condyles of the Os Femoris; the
great

great ligament only giving way by a sort of small reciprocal contorsion of its lower extremity. It is necessary here to review what was said in the description of the skeleton.

1018. The popliteus performs the rotation of the leg when bent, in a direction contrary to that of the *Popliteus*. biceps The biceps turns the leg from before outward; the popliteus from before inward. This rotation therefore answers to the pronation of the radius by the pronator teres, as that made by the biceps tibiæ does to the supination made by the biceps of the arm.

1019. This muscle is commonly reckoned among the flexors of the leg; but it seems very ill contrived for such a function, because of the obliquity of its situation, and because its insertion is so near the centre of motion of the joint. By its connection with the capsular ligament, it may serve to prevent its being caught between the two bones in the flexions of the leg.

§ 10. *Uses of the muscles which move the tarsus and the other bones of the foot.*

1020. The tibialis anticus bends the foot, that is, turns the point of the foot toward the leg, *Tibialis Anticus*. which motion is performed by the ginglymoide articulation of the astragalus with the tibia and fibula. It likewise bends the leg on the foot, or hinders its extension. The first of these uses is generally known; and we have an instance of the second every time we stand or walk. When we stand, the feet being turned directly forward, this muscle, like a frænum, keeps the leg in æquilibrium, and hinders it from falling backward. This use is still more evident when we walk backward.

1021. By its lateral insertion in the Os Cuneiforme maximum, it moves this bone in particular over the anterior extremity of the Os Calcis; by which the sole of the foot is turned inward, toward the other. This lateral situation of its insertion is the reason why it cannot bend the foot directly, without the help of the anterior peronæi; neither can it alone keep the leg in æquilibrium when we stand on one foot.

1022. The peronæus medius bends the foot, and hinders the leg from falling back in the same manner as the tibialis anticus. By its

Peronæus medius et minimus.

its insertion in the tuberosity of the fifth metatarsal bone, it turns the sole of the foot outward at the same time that it bends it, when it acts without the assistance of the tibialis anticus; the co-operation of which muscle is likewise necessary to enable it to counterbalance the force with which the leg would be carried backward, when we stand upon one foot.

1023. The peronæus minimus is an assistant to the medius in the flexion of the foot, in preserving the æquilibrium of the leg, and in turning the sole of the foot outward; neither can it perform the first two of these motions uniformly without the co-operation of the tibialis anticus.

1024. The uniform flexion of the foot furnishes an example of all the three kinds of levers; of the first, when we bend the foot while off the ground, in which case the fulcrum is in the articulation between the two extremities of the lever; of the second, when we walk upon the heels or toes, for then the weight is between the power and the fulcrum; of the third, when we raise a weight by the toes, for then the power is between the weight and the fulcrum.

1025. The gastrocnemii and soleus make a kind of triceps, and by their common tendon extend the foot and keep it extended against the strongest resistance. It is by their means that we raise the whole body even with an additional burden, when we stand a tip-toes; and that we walk, run, and jump. The length of the posterior portion of the Os Calcis gives them a great advantage in acting, by removing the line of their direction from the axis of motion.

Gastrocnemii et soleus.

1026. The motions of the foot performed by these muscles may be referred to the first two kinds of levers. When we stand a tip-toes, the foot represents a lever of the second kind, the fulcrum being then at one end, the power at the other, and the weight between them; and we have a lever of the first kind, when the leg being fixed, we endeavour to overcome any moveable resistance with the toes, or whenever we move the foot held off the ground.

1027. These muscles not only extend the foot on the leg but likewise the leg on the foot, as appears evidently when after a moderate genuflexion we raise our bodies; for then the foot remains fixed while these muscles extend the leg;

leg; and it is here to be observed, that this genuflexion is not made by the action of any flexors, but only by the relaxation of the proper extensors, according to what was taken notice of in the beginning of this section, N^o 51.

1028. The gastrocnemii, by their insertion in the Os Femoris, may in great efforts move the leg on the thigh, and the thigh on the leg, as assistants to the biceps, semi-membranosus, semi-tendinosus, gracilis internus, and sartorius. In these motions the superior extremities of the gastrocnemii cross under the lower extremities of the muscles last named. The fleshy fibres of the gastrocnemii are very long, and there is a great distance between their two insertions; and, on this account, these muscles are better fitted for large degrees of motion than for strength.

1029. The soleus, by the multitude of its fleshy fibres and its penniform structure is more proper for strong than large motions, and seems principally to sustain the gastrocnemii in the motions begun by them. The tendinous portions of this muscle and of the gastrocnemii, though they form a strong tendon all together, seem nevertheless to slide a little upon each other in the different flexions and extensions of the foot.

1030. From the description of the tibialis gracilis we see evidently that it can have no use with relation to the sole of the foot. The use assigned to it by others of extending the tarsus, and thereby assisting the gastrocnemii and soleus, seems to me to be very uncertain, both because of the great disproportion in its size, and the obliquity of its course. If the soleus were not covered by the gastrocnemii, the tibialis gracilis might be imagined to serve as a frænum in bracing down that muscle, and hindering it from swelling too much; but the small number and direction of its fibres, would still render it unfit for that function.

1031. Till its true use is evidently discovered by some lucky observation, there is in the mean time some ground to think that it hinders the capsular ligament of the knee from being compressed in the flexion of that joint; both because of its adhesion to that ligament, and because of the obliquity of its course, especially since the neighbouring portion

of the same ligament seems to receive the same assistance from a tendinous expansion of the semi-membranosus.

1032. When the tibialis posticus acts alone, it extends the foot obliquely inward. When it acts together with the gastrocnemii and soleus, it changes the straight direction of their motion to an oblique one. When it acts with the tibialis anticus, the sole of the foot is turned more directly inward or toward the other foot.

Tibialis posticus.

1033. When the peronæus longus or maximus acts alone, it may extend the foot hanging freely in the air; but then this extension is obliquely outward. Together with the gastrocnemii and soleus, it likewise changes their direction to an oblique extension outward.

Peronæus maximus.

1034. This muscle, and the tibialis posticus acting without the gastrocnemii and soleus, may extend the foot almost directly, but they can overcome but a very small resistance. When it acts with the other two peronæi, the sole of the foot is turned more or less directly outward toward the external malleolus.

1035. I cannot help repeating once more, that in order to conceive these uses as we ought, it is very necessary to review the description of these muscles, and what was said concerning the mechanism and uses of the bones of the tarsus.

1036. The extensor pollicis longus extends the two phalanges of the great toe; and it may likewise be an assistant to the tibialis anticus.

Extensor pollicis longus, flexor pollicis longus, thenar & antithenar.

1037. The flexor pollicis longus not only bends the second phalanx of the great toe, but may likewise serve in great efforts, as an assistant to the extensors of the tarsus. This muscle is of great use in climbing up a steep place.

1038. The thenar bends the first phalanx of the great toe. When the portion nearest the inner edge of the foot either acts alone, or acts more than the rest, the great toe is separated from the other toes, especially if it be at the same time extended. This separation may be greater or less, according to the degrees of action of the other portions of the thenar.

1039. The antithenar acting with the thenar, bends the first phalanx of the great toe. When it acts alone, especially if the great toe is bent, it brings it nearer the other toes, in proportion to the degrees of action of its different portions.

1040. The two extensors digitorum communes concur in extending the four small toes; and as the *Extensor digitorum longus & brevis.* extensor longus is not near so fleshy as that of the hand, this difference is made up by the extensor brevis. The longus alone seems to extend the first phalanges; and they both join in the extension of the second and third phalanges; the brevis by the obliquity of its direction moderating the action of the longus, which otherwise would have turned the toes obliquely the contrary way.

1041. The extensor longus may likewise assist the tibialis anticus, and peronæus anticus in great efforts, or in keeping the foot bent; as when we would raise a weight upon the toes, or overcome any other resistance. Lastly, one extensor alone would not have been sufficient to counterbalance the common flexors.

1042. The perforatus or flexor digitorum brevis, bends the second phalanges; and the perforans or flexor longus, the third; the use of these muscles being nearly the same with those of the perforatus and perforans of the hand. *Perforatus, perforans, flexor accessorius & lumbricales.*

1043. The flexor accessorius, which might very justly be termed *plantaris*, is an assistant to the perforans, increasing its force on some occasions. It likewise directs the tendon of that muscle; for by contracting at the same time that the fleshy belly of the perforans is in action, it makes the tendons go in a straighter line to the toes than they would otherwise do, because of their obliquity. It has likewise another use with relation to the lumbricales.

1044. The lumbricales have nearly the same functions in the foot as in the hand; and they are partly assisted and partly directed by the flexor accessorius.

1045. The interossei of the foot have the same uses as in the hand. The first superior muscle brings the second toe near the great toe; the other three bring the second, third, and fourth toes near the little toe. *Interossei.*

The

The three inferior muscles move the last three toes toward the other two. I here speak according to the situation which I have most frequently observed ; but as that situation varies, the uses must likewise be different.

1046. The metatarsius moves the last bone of the metatarsus, much in the same manner as the metacarpus does that of the metacarpus. By this action it draws likewise the fourth bone along with it, and contracts the sole of the foot, increasing the convexity of the upper side ; provided that the foot is not become inflexible by long wearing strait shoes, by old age, or by any other constraint or indisposition.

Metatarsus, transversalis, parathenar major & minor.

1047. The transversalis may assist the metatarsius in this action, which is supposed to be of use to tilers in climbing. The antithenar may likewise concur, and the peronæus minimus may serve to counterbalance these muscles, and to bring the metatarsus back to its natural situation. The common extensors, by their nearest tendons, may likewise be antagonists to the metatarsius and transversalis.

1048. The parathenar major serves particularly to separate the little toe from the rest ; and the parathenar minor bends the first phalanx of that toe. Both these muscles seem to be too large and strong, for the necessary motions of so small a part on so weak a joint. But as the little toe makes a part of the outer edge of the sole of the foot, which is very much exposed to external violence when we walk barefooted, and no part of it so much exposed as the little toe, very powerful muscles were necessary to strengthen it on these occasions.

1049. Besides the two uses already mentioned, the great and small parathenar may have another in which they may likewise be assisted by the thenar ; and that is, to bend the sole of the foot according to its breadth, which action is very requisite in walking a-tip-toes, in going up a ladder, and in climbing ; on which account the two parathenars deserve the name of the tiler's muscles, much better than the transversalis pedis.

§ 11. *Uses of the muscles employed in respiration:*

1050. In describing these muscles, I began by the diaphragm ;

phragm; but in giving their uses, all the other muscles must go before it, for a reason which will appear hereafter.

1051. The scaleni seem better fitted for the motions of the neck than for those of respiration; and I frankly acknowledge, that, in reflecting on this, while this page was in the press, I began to doubt of this latter use, especially when I called to mind what I said about the uses of the subclavius, N^o 822. viz. that I could not believe this muscle to be employed in respiration, because of its insertion in the cartilaginous portion of the first rib, which is immoveably fixed to the sternum, and likewise much shorter, much broader, and consequently much less flexible than the cartilages of the other ribs.

1052. Moreover, the neck in many situations cannot serve as a fixed point to the scaleni for the motion of the ribs; as for instance, when it is bent forward over the sternum, or inclined very much to either shoulder; and yet we find that none of these situations do in the least hinder the motions of respiration.

1053. From this time therefore, I shall rank the scaleni among the muscles which move the vertebræ of the neck; because the articulation of the first rib on both sides, with the first vertebra of the back, seems to serve only for the motion of that vertebra on the rib, and not of the rib on the vertebra. In this manner ought truth to be embraced whenever it presents itself.

1054. The serratus posticus superior, is disposed to move upwards the three or four upper ribs next the first. And if any portion of this muscle should be observed to be inserted in the first rib, that could only serve for the motion of the vertebræ with which that rib is articulated, and not for the motion of the rib itself, because of the stiffness and immobility of its cartilaginous portion.

1055. The serratus posticus inferior is still better disposed for depressing and keeping down the last three or four false ribs.

1056. The use which has been assigned to these two muscles of being vaginæ or moveable fræna to the longissimus dorsi and sacro-lumbaris, is without foundation; for the portions of these muscles covered by the serrati, have no more need of such a contrivance than those which are not covered by them.

1057. The

1057. The posterior fibres of the external intercostals, are fixed by their upper extremities so near the articulation of the ribs with the vertebræ, that they cannot depress that rib in which they are so inserted; whereas the insertions of their lower extremities in the following rib, being at a greater distance from the articulation, they may move that rib upward. And from thence it follows, that all the remaining part of each external intercostal which terminates at the bony extremity of each rib, can only serve to raise the lower rib, toward the upper.

*Intercostales, &
supra-costales.*

1058. The anterior fibres of the internal intercostals are so near the articulation, of the ribs with the sternum, that they cannot depress that cartilage in which each of them is inserted; whereas the inferior insertions of these fibres being at a greater distance from the articulation, they are in a condition to raise the cartilages in which they are so inserted. From whence it follows, that all the internal intercostal muscles have the same use with the external, and that they can have no other.

1059. The portions which lie between the two extremities of the ribs, serve to increase the force of the same uniform action. And the first rib being immoveable, serves for a fixed point for the motions of all the other ribs, and each rib in particular serves for a fixed point for the motion of that below it.

1060. The supra-costales are powerful assistants to the intercostals in their common action, and are therefore very justly termed *levator costarum*. But we must not confound with these, a small muscle immediately above the first rib, which by its insertion in that rib, looks like them at first sight.

1061. The insertions and direction of the sterno-costales being carefully examined, it will be found that their use is to depress the cartilaginous portions, and anterior extremities of the ribs, especially the superior ribs, except the first; and at the same time to draw the cartilages of the inferior ribs near the sternum, by reason of the curvature. They may therefore very well be called *depressores costarum*, as the supra-costales are named *levatorcs*.

*Sterno-costales
& sub-costales.*

1062. The sub-costales having the superior extremities of their

their fibres much more distant from the vertebral articulations of the ribs, than the lower extremities; it follows, that they can more easily move the upper than the lower ribs, and consequently, that they are assistants to the sterno-costales.

1063. The diaphragm, together with the intercostal muscles, the ribs, sternum, and vertebræ of the back, forms the cavity of the thorax, and it divides this cavity from that of the abdomen.

1064. Its particular use is to be the principal organ of respiration, that is, of the alternate expansion and contraction of the thorax. The other muscles already mentioned are to be considered only as assistants and directors, in order to facilitate and regulate these motions, which in the ordinary state are perpetual, but which may, by the action of these other muscles, be accelerated, retarded, or even be suspended for some space of time.

1065. The diaphragm may move, when the ribs are at rest, and consequently without the assistance of the muscles which move the ribs; and this motion may be sufficient to keep up the alternate dilatation and contraction of the thorax, without which the animal cannot live.

1066. In a word, we may continually expire and inspire by means of the diaphragm, whether the ribs move or remain at rest; and whether the thorax be kept for a considerable time in a state of great dilatation or of great contraction; for this does not hinder the diaphragm from continuing its motions.

167. We cannot explain this mechanism, till we have first described several other organs on which it depends; and therefore it must be referred to the treatise of the thorax.

§ 12. Uses of the muscles which move the head on the trunk.

1068. The action of the sterno-mastoidæi is different, according as either both muscles or only one of them acts, and according to the different situation of the head and trunk.

1069. When we keep the head and trunk straight, whether in standing or sitting, both muscles preserve the head in that posture, against any force by which it would otherwise be moved backward. This we may be convinced of, by laying

laying the hand on these muscles, while we endeavour to resist a force which pushes back the head.

1070. One of these muscles acting alone, may have the same use, if the force to push the head back be applied between the anterior and lateral parts of it. In that case, the sterno-mastoidæus on the same side would oppose this force; but if it were applied directly on the side of the head, that opposition would have no effect without the assistance of the splenius on the same side.

1071. They both serve likewise to perform the rotations of the head, that is, to make it turn to either side as on a pivot; and in this case, when we turn the head to one side, the sterno-mastoidæus on the other side acts, and not that on the same side; this is an observation of consequence in paralytical disorders.

1072. They both serve, in the next place, to bring the head near the thorax when we lie on the back, or bend backward in sitting. And the lower the head is in these situations, the more force must these muscles exert to raise it. In this case the sternum being the fixed point, must remain immoveable; but as its connection with the first rib, and the inflexibility of the cartilage of that rib, are not always sufficient for this; the musculi recti of the abdomen must lend their assistance in great efforts.

1073. In most people, we may feel this co-operation of the abdominal muscles, in raising the head when they lie on their back, by laying the hand on these muscles. But when the cartilage of the first rib is very much hardened, and the articulation quite deprived of motion, as where the first and second ribs are partly confounded together, of which I have seen instances; in such people, the sternum does not want any other assistance to keep it immoveable, and therefore the co-operation of the muscles of the abdomen would not be perceivable.

1074. When being in an erect posture, either standing or sitting, we lower the head, the sterno-mastoidæi do not act, neither have they any share in that posture. It is produced only by the relaxation of the posterior muscles, by which alone the head is sustained in this erect posture, and without which it would naturally fall forward, as we see in those who fall asleep, or are taken suddenly ill, while sitting.

1075. The insertions of these muscles in the posterior part of the mastoide apophyses, has made some anatomists believe that they are more proper to bend the head backward than forward; their insertions being behind the condyloide articulation of the Os Occipitis; and to this they might have added, that the neck, from the natural disposition of the vertebræ, is better fitted for flexion backward than forward.

1076. But, in the first place, as these insertions take up a great deal of room, the moveable point can only be determined to that part which is nearest the fleshy body, and the most anterior; and consequently not situated so far back as is imagined.

1077. In the second place, as the motion of the head forward, by these muscles, is distinct from that of the neck, the anterior muscles of the vertebræ of the neck must act at the same time, and hinder them from bending backward; so that, in this case, the neck may be looked upon as a pillar, the upper part of which supports the head, while the head acted upon by the muscles, carries the lower part of it forward. It is for want of this co-operation that experiments made on dead bodies have been apt to mislead.

1078. The two splenii serve to support the head in an erect posture, whether in standing or sitting, to moderate the flexion of the head forward, and to bring it back again to its natural posture.

1079. They serve alternately to co-operate with either of the sterno-mastoidæi for the rotation of the head; thus when the right sterno-mastoidæus turns the head, the left splenius corresponds with it by its upper part; while the lower part at the same time turns the vertebræ of the neck.

1080. When we lie on one side and raise the head laterally, the splenius and sterno-mastoidæus of the opposite side act in concert. Also when we stand and incline the head to one side, it is the splenius and sterno-mastoidæus of the other side which moderate that lateral flexion, and afterwards extend the head. And as the sterno-mastoidæus is partly inserted in the clavícula, the latissimus dorsi concurs likewise in this action, and fixes the clavicle by means of its connection with the Os Humeri, which is of considerable advantage in the action of the sterno-mastoidæus.

1081. The complexi are assistants to the splenii, to keep the

the head straight in sitting or standing, to hinder it from inclining forward, and to raise it when inclined. When they act together, they, as well as the splenii, may move the head backward, while the trunk is bent forward, or when we lie upon the belly. This latter motion is commonly named *extension*, the other *flexion*.

1082. When the splenius and complexus of one side act together, they may support the head when obliquely inclined to the opposite side; bring it back again to its natural situation, and incline it obliquely toward the side on which they lie.

1083. The recti majores and minores postici, and obliqui superiores turn the head a little backward on the first vertebra of the neck; and they can neither act otherwise nor separately. The recti majores contribute most to this motion; and the minores seem likewise to hinder the articular membranes from being pinched between the bones in great motions.

Recti postici, obliqui superiores, &c.

1084. The recti majores and minores and antici, and the two transversales antici move the head forward on the first vertebra; and the recti minores and transversales breves, likewise defend the capsular ligaments.

Recti antici et transversales antici.

1085. The obliqui inferiores or majores are true rotators of the head, by turning the first vertebra upon the odontoide apophysis of the second; all which alternate motions the head follows, without being hindered in the motions forward and backward in any degree of rotation.

Obliqui inferiores.

1086. These oblique muscles cannot perform any other motions, being only assistants to the splenii and sterno-mastoidæi. The obliqui minores can have no share therein, they being limited to the inflexion backward, as has been already said. The obliquity of their direction, which may have deceived some anatomists, seems only to be contrived to make way for the insertions of the complexi minores.

1087. Of the transversales antici, the first only move the head in the manner above mentioned; neither can they perform any other motions, their insertions being confined to the Os Occipitis and first vertebra. The transversales antici secundi have no share in the particular motions of the head,

but ought rather to be ranked among the muscles which move the vertebræ of the neck.

1088. The *complexi minores* belong to the head only by their superior portions; the other portions belonging rather to the neck. They may serve alternately in the lateral motions of the head, and thereby co-operate with the *splenius* and *sterno-mastoidæus* of the same side, when these two act together; and they may likewise be of use to preserve the capsular ligaments to which they adhere.

1089. The small *accessorii* when they are found, have the same uses with the muscles to which they are supernumerary.

§ 13. *Uses of the muscles which move the vertebræ.*

1090. The particular motions of the neck seem always to be accompanied with those of the head; but there are several of these motions in which the head is only carried along with the first vertebra, as if it adhered immoveably to it. The neck thus considered may be bent forward, straightened, bent backward, inclined to each shoulder, and turned as on a pivot, by a rotation different from that of the first vertebra on the second.

1091. The *scaleni*, when they act on each side at the same time may assist in bringing the neck forward, when we lean back in any respect. When those of one side act by themselves, they make a lateral inflexion either of all the vertebræ of the neck together, as in bending the middle of the neck; or of some only, as in bending the lower part of the neck alone. These lateral inflexions cannot be made indirectly with the help of the inferior portion of the *splenius*.

1092. The *longi colli* bring the neck forward by the lower part of the inferior portions. When one of them acts alone, or acts more than the other, this motion is more or less oblique. The remaining part of these muscles has no hand in these motions, which seem to be peculiar to the last vertebræ of the neck on the first of the back.

1093. By the upper and greatest part of the lower portion they counterbalance the posterior muscles of these vertebræ and

and hinder the neck from bending backward by the contraction of the sterno-mastoidæi, when, lying on the back, we raise the head.

1094. It must here be remembered, that the natural situation of the bones of the neck is oblique on the forepart, and that the neck is bent in such a manner, as that the convex side of the curvature lies forward, and the concave side backward. Therefore when we would hold the neck straight, and bridle it, as it is called, this curvature must be destroyed. This is done by these two muscles which in this case make an extension, in a manner, in opposite directions, and fix all the vertebræ of the neck close to each other as if they were but one bone.

1095. The longus colli of one side performs these motions obliquely, and may likewise co-operate in the lateral inflexions of the neck with the scaleni and other muscles which perform these motions, as we shall see afterwards.

1096. The transversalis major, transversalis gracilis, and the little transversales, acting on one side, can have no other use but to bend the neck lateral-ly; and to hinder these inflexions when they act on both sides. The small transversales may likewise preserve the capsular membranes of the joints from being compressed, or otherwise hurt by the motions of the oblique apophyses. *Transversales.*

1097. The semi-spinales or transverio-spinales of both sides acting together, extend the neck upon the trunk, to keep it from inclining forward in standing or sitting, and bend it backward. The semi-spinales of one side acting alone, produce the same motions in an oblique direction, and in that case they are assisted by the inferior or vertebral portion of the neighbouring splenius under which they cross. *Semi-spinales.*

1098. The semi-spinales of both sides may likewise serve for the rotation of the neck, but then the inferior splenius of the opposite side must assist them. This motion is made in the ordinary situation of the neck, chiefly on the fourth and fifth vertebra. They may likewise perform the lateral inflexions of the neck, by assisting the longus colli and anterior vertebral muscles of the same side.

1099. The inter-spinales are assistants to the semi-spinales in their mutual action, and may likewise *Inter-spinales.*

likewise serve to bring back the neck to its natural situation, after small motions of rotation.

1100. The vertebræ of the back are moved by being bent forward, by being extended or straightened, and by being inflected directly or obliquely toward each side. The motion of rotation has no place here, because of the particular structure of the joints of these vertebræ and their connection with the ribs, which likewise hinder the flexion backward. Flexion and extension are the two principal motions, and much more apparent than the others.

1101. The flexion of the back forward is not performed by any particular muscles, but depends, both in standing and sitting, on the relaxation of the muscles that extend or straighten it, and keep it in that erect posture. In that case the weight of the head obliges the vertebræ to bend forward more or less in proportion to the degree of relaxation of the extensor muscles.

1102. To facilitate this flexion, we commonly raise the shoulders; which being done by the action of the serratus major, the rhomboides must be relaxed at the same time, by which the upper part of the back is left at liberty. The lower part is most easily bent, because, the false ribs not being fixed by their anterior extremities, advance forward sliding a little upon each other.

1103. When we lie upon the back or side, this flexion is performed chiefly by the abdominal muscles; so that the greatest part of the uses of all the muscles belonging to the vertebra of the back, is confined to extension alone.

1104. The two sacro-lumbares maintain the back and the regio-lumbaris in their natural situation when *Sacro-lumbares.* we stand or sit; and, by the relaxation of their fibres more or less, the trunk is proportionably bent forward by the weight of the head and breast. They likewise extend the back and loins in all postures, keep them steady and fixed under the weight of burdens, and bend the loins backward.

1105. One of them acting alone, may have the same uses of bending forward, extending, resisting and bending backward, but with less strength, and in an oblique direction, as when the body is inclined obliquely forward, and to one side at the same time, or extended from that posture. They likewise

wise serve to counterbalance the oblique muscles of the abdomen, in turning the thorax upon the pelvis, as mentioned N^o 130.

1106. These muscles may in some respects be compared with the splenii; *i. e.* their superior insertions with the mastoide insertions of the splenii; and their inferior insertions with the vertebral insertions of these muscles. The mastoide portion of the splenius is longer, more distant from the articulation, and more disposed to perform large motions, and to resist great efforts than the vertebral portion. In like manner the costal portion of the sacro-lumbaris, by the length of the tendinous series, by their graduated insertions in the ribs, and by their obliquity, is better disposed for the uses already mentioned, than the vertebral portion.

1107. The small muscular fasciculi which cross these tendinous portions, called *musculus sacro-lumbaris accessorius*, seem to counterbalance and moderate the depression of the ribs in the great efforts of the sacro-lumbaris.

1108. The use of these muscles in progressive motion, is not sufficiently demonstrated. It is supposed that while we lift one leg to make a step, the sacro-lumbaris of the other side sustains the vertebræ of the loins and back, to prevent their yielding to the psoas, which lifts the leg, and puts it in motion; but the direction of the greatest part of the fibres of the sacro-lumbaris is very improper for such an use.

1109. The use of the sacro-lumbaris in respiration is likewise attended with difficulties; for when the body is very much inclined forward, and even much loaded, the ribs continue still to be raised with the same ease as they are depressed, though the sacro-lumbaris is chiefly employed in this case; but it is to be remembered that I speak here only of bending and loading the back, not of loading the shoulders. In the first case the ribs move easily, but not in the second.

1110. The longissimus dorsi is an assistant to the sacro-lumbaris, especially to the vertebral portion of that muscle, which it helps very powerfully both by the multiplicity and insertions of its fibres, in sustaining the vertebræ of the back and loins while extended, whether in sitting or standing, and in preventing their sinking under the weight of the body, or of any additional burden. It assists in performing and in counterbalancing all the

Longissimus dorsi.

the motions and inflexions of which these vertebræ, especially those of the loins, are capable in all postures of the body; and in this it bears likewise some resemblance to the inferior or vertebral portion of the splenius; and it must here be remembered, that these two muscles on each side, and the sacro-lumbares are of the number of those called *vertebrales obliqui divergentes*.

1111. All the spinales and transversales of the back and loins belonging to the class of the *vertebrales recti*, the spinales to the middle muscles, and the transversales to the lateral, according to the idea given of them when I spoke of the vertebral muscles in general, their chief uses must be to assist, moderate, and maintain the motions of extension and lateral inflection, whether simple and direct, or oblique and compound; much in the same manner as is done by the like muscles of the neck.

1112. The spinales majores and transversales majores have this peculiar to them, that their fleshy portions not lying in a straight line between their insertions, they may perform not only direct motions when they act in even numbers, but also oblique motions when the numbers on each side are unequal. The small spinales and transversales being confined between two neighbouring vertebræ, cannot co-operate but in direct extensions and inflexions.

1113. The semi-spinales or transverso-spinales being oblique, converging, vertebral muscles, are assistants to the sacro-lumbaris and longissimus dorsi, which they cross on each side.

By this decussation joined to the multiplicity and graduated distribution of their insertions, they increase the strength of the other muscles considerably, whether they act equally and uniformly with them, or alternately. The lumbar semi-spinales, called by the ancients *musculus sacer*, because of their insertions in the Os Sacrum, are more exposed to motions and strains than those of the back, and are likewise larger and thicker. They are much better fitted than the sacro-lumbares for supporting the pelvis on both sides in walking, and on one side, when we raise the foot on that side, and support ourselves on the other.

1114. The quadratus lumborum and psoas parvus are of the

the same use to the vertebræ of the loins as the scaleni to those of the neck. When both quadrati act, they keep the lumbar pillar straight, that is, so as not to incline to either side, and then they may assist the recti of the abdomen in the inflexions forward, and the superior portions of the obliqui in lateral inflexions.

*Quadratus lumborum
& psoas parvus.*

1115. They may likewise serve to support the haunches alternately in walking; and in standing on one foot, the quadratus of the opposite side may support the haunch of that side; in which action they co-operate with the transversospinales and posterior parts of the obliqui abdominis.

1116. The psoas parvus when it is found, serves to sustain the pelvis much in the same manner with the muscoli recti of the abdomen, in climbing, &c. But when we stand, we have no need of such a support, the pelvis resting then upon the *Ossa Femoris*, in such a manner as that the largest portion thereof, and that which supports the whole body, lies behind that fulcrum, and the smallest part before. It may likewise serve to hinder the vertebral pillar from bending backward on some occasions.

1117. The coccygæus anterior may sustain the coccyx in æquilibrium, and hinder it from being bent backward, and from being luxated in great strains, as in the excretion of hardened fæces, &c.

*Coccygæus
anterior.*

1118. The coccygæus posterior can only serve to replace the *Os Coccygis* when it has been forced backward, and to hinder it from being luxated backward.

*Coccygæus
posterior.*

§ 14. *Uses of the muscles which move the lower jaw.*

1119. The two temporales acting together, raise the lower jaw, press the teeth in that jaw against the upper teeth, and pull it back when it has been carried so far forward, as that the lower incisores get before the upper. They perform the last motion by their most posterior portion which passes over the root of the zygomatic apophysis, and the other motions by the co-operation of all their muscular radii.

Temporalis.

1120. The two masseteres serve to raise the lower jaw, and

Masseter. to push the lower teeth against the upper, in which use they co-operate with the temporales. They likewise bring this jaw forward by their external and largest portion; draw it back by their middle portion; and move it laterally by their superior portions acting alternately. By the co-operation of all the three portions, they press the lower teeth against the upper.

1121. Both pterygoidæi interni serve to raise the lower jaw, to bring the lower teeth near the upper, and to move the jaw laterally, as in grinding the food. They cannot bring the jaw a great way forward, in order to set the lower incisors before the upper, and they can be of no use in bringing it back.

Pterygoidæus internus. 1122. The two pterygoidæi externi bring the lower jaw forward, in order to set the lower incisors before the upper, in which action they are antagonists to the posterior portion of the temporales, and the great portion of the masseteres. When one of them acts, it carries the chin obliquely forward, or turns it towards the other side. This oblique motion is performed alternately by these two muscles acting singly.

Digastricus. 1123. The two digastrici serve to depress the lower jaw, and to open the mouth; in doing which, the mechanism of these muscles has appeared to all anatomists to be very singular, on account of their middle tendons, their insertions, adhesions, and their manner of passing by another muscle. The incurvation of this middle tendon has not only been looked upon as necessary to change the direction of the muscles, but it has been believed, that, without this change of direction, they could not have depressed the jaw any further than the weight of the jaw would contribute to that action.

1124. This incurvation and passage has been compared to that of a rope over a pulley, without which advantage it was thought that these muscles could not resist the continual efforts of their powerful antagonists, nor overcome any exterior opposition, such as that of the hand pressing upon the chin. But when we examine carefully the structure of the jaw and the insertions of these muscles, it appears evidently that their connection with the Os Hyoides is not necessary for
the

the use assigned to them of depressing the jaw; as may be proved both on a skeleton and on a fresh subject.

1125. In a skeleton in which the motion of the lower jaw is preserved by art, we need only tie a piece of packthread to the lower part of the chin where the digastricus is inserted, and then keeping the lower jaw close to the upper by any proper contrivance, pass the other end of the string through the mastoide groove, and we will perceive, by pulling the string in a straight direction between these two places, that the jaw will be depressed.

1126. This experiment may be made without the help of a spring, or any other contrivance to keep the jaw shut, by simply inverting a proper scull, so that the lower jaw may by its own weight fall on the upper; for, by drawing the string as before, the lower jaw will be raised, that is, parted from the other, and by letting the string go, it will fall back again to its first situation.

1127. On a fresh subject the experiment may be made in the following manner. The connection of the digastricus with the Os Hyoides and musculus stylo-hyoidæus being entirely destroyed; let it be pulled by its posterior extremity directly toward the mastoide groove, in the same manner as the string was drawn in the foregoing experiments.

1128. Anatomists have not considered that the two rami of the lower jaw are crooked or angular levers, and that each digastricus passing by the angle in that bone, ought to be looked upon as being inserted therein, so that the action of the lever is to be confined to that portion which lies between the angle and the condyle, without taking in what lies between the angle and the chin.

1129. It may be asked therefore why the anterior insertion of the digastricus reaches so far as the chin, since it might have been in the angle of the bone; and what is the use of its connection with the Os Hyoides, of its incurvation, and change of direction. The first question is answered by calling to mind what has been said about the extent or largeness of motion about the necessity of long fibres for large degrees of motion, and about lateral motions. Had this muscle been inserted in the angle, its fibres would not have been proportioned to the degrees of motion required, and for the same reason the lateral motions would have been obstructed.

1130. In answer to the second question about the connection of this muscle with the Os Hyoides and its incurvation, it is to be remembered that the digastricus has another use besides that of depressing the lower jaw; which is to assist in deglutition, of which it is one of the principal organs. I demonstrated this use of the digastricus above eight years ago in my public courses in the physic-schools, and at the royal garden; but as the whole mechanism of deglutition cannot be explained till the tongue, larynx, and pharynx have been described, I shall only add in this place the following remarks, to prove the use of the digastrici in that action.

1131. We cannot swallow without raising the larynx or pomum Adami, as it is commonly called, at the same time, as every one may satisfy himself by laying his hand on that part of the throat in the time of deglutition. We are likewise obliged to keep the lower jaw raised while we swallow, and when it is depressed, we find that action impossible. Lastly, the larynx cannot be raised but by means of its connection with the Os Hyoides; and the muscles of that bone are too weak to resist the efforts of the basis of the tongue, and of the solid food which we swallow.

1132. Therefore while the temporal and masseter muscles keep the lower jaw closely applied to the upper, in deglutition, the digastrici contract at the same time, as may be felt by putting the end of the finger upon the place where they are inserted in the edge of the chin. And as the lower jaw remains immoveable, the digastrici are streightened by their contraction, and by the connection of their middle tendons with the Os Hyoides, they raise that bone, and the larynx together with it.

1134. The force of these muscles is very considerable, as may be shewn by laying the elbow on a table, and leaning with the chin on the hand, while we endeavour at the same time to depress the lower jaw; for as in that case this jaw cannot descend, the digastrici, by their insertions in the apophysis mastoidea, raise the upper jaw by bending the head backward on the condyles of the lower jaw. A piece of wood supporting the chin in place of the arm, will render this experiment more sensible and more certain. The
involuntary

involuntary motion termed *yawning*, is likewise a proof of the strength of these muscles.

1135. In the action of the *digastrici* in deglutition, we meet with one very singular phenomenon, of which there is hardly another example to be found among all the muscles of the human body. For in all other instances, wherever antagonist muscles act at the same time, they all co-operate in producing what is called a *tonic motion*; but in this case the levators and depressors of the lower jaw act together for different uses; that is, the temporal and pterygoide muscles are in action to raise the jaw, and to keep it in that situation, while the *digastrici* their antagonists perform an office which has no relation to that bone.

1136. Two eminences in one bone articulated with two cavities in another, allow only of two contrary motions as in a ginglymus, *Contrivance of the interarticular cartilages.* and in the articulation of the *Os Occipitis* with the first vertebra. But the lower jaw, though articulated by its two condyles with the glenoide cavities of the *Ossa Temporum*, has four direct motions, one forward, one backward, one downward, and one upward; and two lateral motions, one to the right, the other to the left. And lastly, in all degrees of the direct motions, it may at the same time have any degree of lateral motions.

1137. This contrivance depends on the interarticular cartilages described among the fresh bones, N^o 348. 349. In the lower side of each of these cartilages, there is but one cavity suited to the convexity of the condyle which it receives; and it is not turned directly downward, but obliquely backward; as the condyle is not turned directly upward, but obliquely forward. The upper side is hollow on the forepart, and convex on the backpart, answering to the articular eminence and fossula of the *Os Temporis*.

1138. In the natural situation of the lower jaw, and while it remains in inaction, it is so disposed, as that the anterior convexity of the condyles answers obliquely to the posterior articular eminences of the *Ossa Temporum*, and with this disposition that of the interarticular cartilages agrees.

1139. In the direct motions upward, the cartilages slide backward and upward toward the meatus auditorius, the condyles still continuing in the cavity of their lower sides;

as is most evidently perceived when we press the teeth hard against each other; and the same thing happens in the direct motions forward. In the direct motions downward, the cartilages slide downward and forward; the condyles still remaining in their inferior cavities, and the same happens in the direct motions backward.

1140. In the lateral motions, the condyles are carried alternately to the right and left sides, and the cartilages follow their motions; so that the condyle on that side toward which the jaw is turned, juts outward, and that on the opposite sinks inward; the prominent condyle having at the same time a small motion backward, and the other condyle forward.

1141. From these observations we learn, that the ginglymoide motions of the lower jaw depend particularly on the inferior cavities of the interarticular cartilages, and that the motions forward, backward, and to either hand, depend on the upper side of these cartilages. The pterygoidei externi move the lower jaw forward; the posterior portions of the temporales move it backward; the left pterygoideus internus turns it to the right hand; and the right pterygoideus internus, to the left hand. The pterygoideus externus of one side, and the posterior portion of the temporalis of the other side, may at the same time perform the small motions mentioned at the end of the last number.

§ 15. *Uses of the muscles which move the Os Hyoides.*

1142. The mechanism observed in the motions of the Os Hyoides, as well as in those of the scapula, is very particular, and very different from what we find in all the other bones of the human body. All these bones have solid fulcra on which they are either moved or kept fixed by the proper muscles, after the manner of a lever or otherwise; whereas the Os Hyoides is merely suspended, having nothing to fix it but these very muscles which move it in different manners.

1143. The mylo-hyoidæus represents a moveable floor or bed, which sustains the tongue with its muscles and glands, and forms the bottom of the cavity of the mouth. When the two portions of this muscle act together, they draw the Os Hyoides a little forward, and

and fix it in that situation, raising the whole tongue at the same time, and compressing the glandulæ sublinguales. If one lateral portion acts more than the other, it puts the Os Hyoides in an oblique situation; and in a condition to serve as a fixed point for the motions of the tongue.

1144. The genio-hyoidæi pull the Os Hyoides much more forward than the mylo-hyoidæus; and as they are very narrow, and closely united together, *Genio-hyoidæi.* there seems to be very little occasion for one of them to act without the other.

1145. The stylo-hyoidæi move the Os Hyoides upward and backward in a middle direction, between those in which they lie; and they draw it more *Stylo-hyoidæi.* upward and backward when they act freely, that is, without being checked or confined by other muscles, in the manner which we shall see hereafter. When one acts more than the other, the bone is moved obliquely.

1146. The omo-hyoidæi or coraco-hyoidæi act as the stylo-hyoidæi in a middle direction between the oblique directions in which they lie, and draw the *Omo-hyoidæi.* Os Hyoides downward and backward, when they are not counterbalanced by the stylo-hyoidæi. When one acts more than the other, the bone is drawn obliquely to the right or left hand.

1147. When these muscles and the stylo-hyoidæi act together, the Os Hyoides is drawn backward by a direct motion compounded of four oblique motions. This compound motion is directed more upward or more laterally according to the degree of action of the stylo-hyoidæi or omo-hyoidæi, or of any one muscle of each pair; and in all these motions, the four muscles are counterbalanced by the genio-hyoidæi.

1148. The length and direction of these two thin muscles, as well as their insertion in the scapula, deserve our attention. To me it seems evident, that, for the uses already mentioned, they could not have been inserted any where else; and therefore that they are fixed in the scapula by a mechanical necessity, and must consequently be very long. Their incurvated direction and situation behind the sternomastoidæi, enables them to perform their several motions in all the different postures of the head; the lateral motions not excepted; for when we turn the head to either side, the
sterno-

sterno-mastoidæus of the same side does the office of a pulley to the Omo-hyoidæus behind it.

1149. The sterno-hyoidæi draw the Os Hyoides directly downward, and serve to counterbalance the different motions of the stylo-hyoidæi, omo-hyoidæi, and genio-hyoidæi. They may in some cases be assisted by the sterno-thyroidæi and thyro-hyoidæi, as we shall see hereafter.

§ 16. *Observations on the co-operation of muscles.*

1150. I took notice, N^o 43. that in order to move any part, or to keep it in a determinate situation, all the muscles belonging to that part must co-operate; and with respect to this co-operation, I distinguished the muscles into principal movers, moderators or antagonists, and directors or collateral movers.

1151. In N^o 44. I observed that all these kinds are to be found in the articulations by enarthrosis, and in many of those by arthrodia; but that in those by ginglymus, the director muscles are wanting. Lastly, that in some cases the moderators do not act; the want of their action being then supplied by the weight of the part to which they are fixed, or by the additional weight or resistance of some other body.

1152. The remarks which were made on the motions of supination and pronation, N^o 894. furnish us with a very singular example of the co-operation of muscles; and it is likewise evidently seen in the motions of the scapula on the trunk, and of the Os Hyoides. But it is chiefly in standing, sitting, progression, and in the motions of the arm, that we observe the co-operation of a great number of muscles proportionable to the situation of the parts.

1153. When we stand in the most common and natural way, the soles of the feet are placed horizontally as the common bases of the whole body. To support the legs like immoveable pillars upon this basis, the muscles which either cover or are fixed in them, must co-operate. The principal movers are the gastrocnemii and soleus; the moderators are the tibialis anticus, and peronæus medius and minimus; and the directors are the tibialis posticus, and peronæus maximus.

1154. The

1154. The legs supported in a vertical situation by the co-operation of all these muscles, as by so many ropes more or less stretched, support the *Ossa Femoris* which are fixed in the proper situation by the action of the two *vasti* and *crureus*; the *rectus anterior* being of no use to the *Os Femoris* in this situation. The *vasti* and *crureus* are here the principal movers, and they act without moderators or directors; for as these bones are bent backward, the weight of the body supplies the place of very strong antagonists.

1155. The thighs in this situation support the pelvis; in order to fix which, the principal movers, moderators, and directors are all employed. But these different offices change in proportion as we stand more or less erect. When we stand very straight, the co-operation of all the muscles which can move the pelvis on the *Ossa Femoris*, may be looked upon as uniform, or as a kind of tonic motion, especially the co-operation of the *glutæi*, *tricipites*, *recti anteriores*, *sartorii*, *semi-nervosi*, *semi-membranosi*, and of the *bicipites* chiefly when the head is a little inclined forward.

1156. The *spina dorsi* and *thorax* are supported in standing by the co-operation of the vertebral muscles and *longissimi dorsi*, which are here the principal movers; of the *sacro-lumbares*, which are partly principal movers and partly directors, and of the *quadrati lumborum*, which are wholly directors. In this situation of the spine, the weight of the *thorax* and of the head, which naturally inclines forward, counterbalances the *vertebrales*, *longissimi dorsi*, and *sacro-lumbares*, and therefore acts in place of moderators.

1157. The head and neck are supported in an erect posture, by the proportionate co-operation of all the muscles which move the head by itself, or together with the neck. The *obliqui majores* are the only muscles which can be supposed to remain in inaction, while the head is kept straight without moving either that or the neck.

1158. The *splenii* and *complexi* are here the principal movers, together with the *spinales*, and *semi-spinales colli*. The anterior vertebral muscles of the neck are rather assistants than moderators in respect of the head, but with regard to the neck they are complete antagonists, without the assistance of which, the neck would bend forwards and the head fall backward, as has been already observed.

1159. In this posture the sterno-mastoidæi act neither as flexors, nor as moderators of the uniform action of the splenii, complexi, and posterior vertebrales; the actions of these muscles being counterbalanced by the weight of the head. Yet the sterno-mastoidæus of one side, together with the splenius next to it; and the other sterno-mastoidæus and splenius likewise taken together are reciprocally principal movers and lateral moderators, assisted by the transversales and scaleni.

1160. From what has been said about standing, we see not only an eminent instance of the co-operation of muscles, but the variety of their uses, and the impropriety of their common denominations. The gastrocnemii, soleus, and tibialis posticus are in this case extensors of the leg, and not of the foot. The vasti and crureus extend the thigh, and not the leg. The recti anteriores do not extend the leg, nor the sartorii bend it, but are all employed in fixing the pelvis on the *Ossa Femoris*.

1161. Progression, or the motion of walking, demonstrates still more palpably, the co-operation of muscles, and at the same time the variety of their functions. In that case the whole body is alternately supported on one lower extremity, while the other hangs in the air. This makes a kind of imperfect standing, in which the co-operation of the muscles is much the same as in ordinary standing with respect to the foot, leg, and thigh; but with respect to the pelvis there is a considerable difference.

1162. To stand straight on the two extremities, the pelvis is only to be kept from falling backward, and sometimes from falling forward. But when we stand upon one extremity, the pelvis must not only be fixed upon the thigh, to hinder it from falling toward the side of the other raised extremity, but the spine must likewise be kept from inclining toward that side.

1163. The pelvis is supported in this case, by a very strong co-operation of the glutæus medius and minimus, as principal movers; and by the glutæus maximus and musculus fasciæ latæ, as assistants; and at the same time the spine is supported by the sacro-lumbaris, latissimus dorsi, and quadratus lumborum of the same side.

1164. In sitting, the pelvis rests on the two tuberosities of the

the Os Ischium, and so cannot fall to either side; but it must be hindered from falling either backward or forward, which is done by the co operation of the recti anteriores, sartorii, semi-membranosi, semi-tendinosi, and the long portions of the bicipites; and to these might be added the iliaci, the psoai, both ordinary and extraordinary.

1165. These observations are sufficient to shew the usefulness and necessity of being well acquainted with the co-operation of muscles; because, without this knowledge, it is impossible to explain the particular motions of some bones, or to discover or remove the disorders or impediments to which these motions may be liable.

1166. I shall only mention one case to shew the importance of such observations. A person complains of a pain at the lower part of the scapula, and that this pain is very acute in every motion of supination or pronation, though he keep the fore-arm bent, which is the most natural, most commodious, and most favourable posture in this case, and holds it close to his side, by means of a scarf, or otherwise.

1167. If we are not acquainted with the co-operation of the rotator muscles of the Os Humeri, in the ordinary motions of supination and pronation, which I explained in giving the uses of the muscles which move the radius, we can never be able to explain or remove this disorder.

1168. The common recourse, when we are without this necessary knowledge, would be to indeterminate ideas of some communication between the nerves and vessels of the fore-arm and those of the shoulder; and the disorder would be imputed to some obstruction in the vessels, or irritation or strain of the nerves, &c. On this foundation, we would order the application of remedies to the parts answering to these vessels and nerves; and when a great length of time had been employed in the cure, the true unknown cause would either diminish or quite disappear of itself, or perhaps increase, and thereby occasion other disorders of worse consequence, and sometimes mortal.

1169. But a person well acquainted with the muscular co-operations, and who knows precisely how to distinguish the muscles proper for each co-operation, can never commit such mistakes.

$$\begin{array}{r} 7x \\ 8 \\ 4x \\ 5 \end{array}$$

$$\begin{array}{r} 7x \\ 70 \end{array} \times \frac{32}{9x} = \frac{4x}{3} + \frac{2x}{9}$$

$$\frac{7x}{8} - \frac{4x}{5} = 8$$

$$7x - 32x = 48$$

$$5x - 32x = 240$$

$$5x = 240 \quad x = \frac{240}{5} = 48$$

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